Worcester Commuter Rail Extension Project

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Millbury Station, Grafton Station, Railroad Operations

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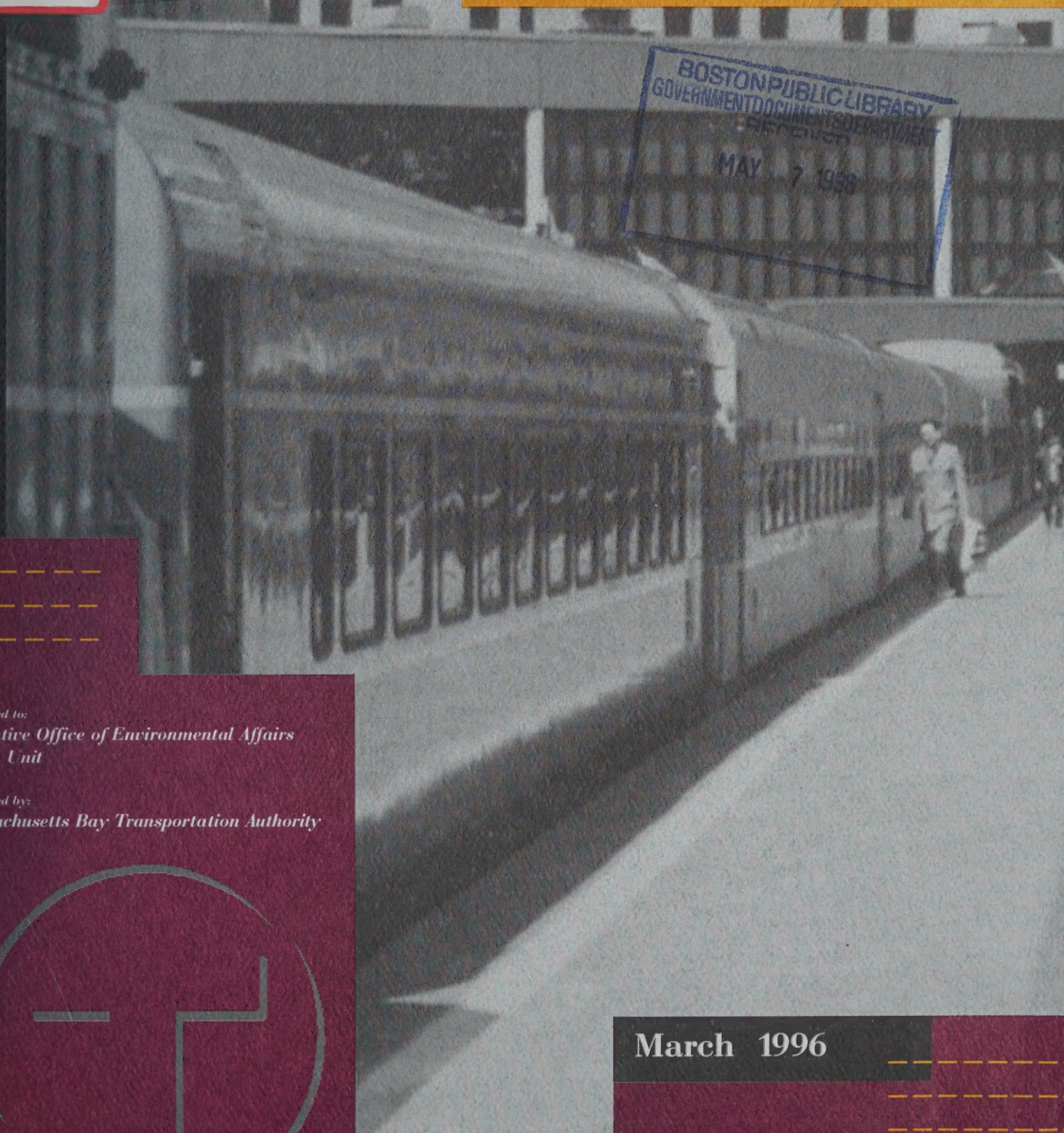

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March 1996

Worcester Commuter Rail Extension Project

FINAL ENVIRONMENTAL IMPACT REPORT

MILLBURY STATION - GRAFTON STATION - RAILROAD OPERATIONS

EOEA No. 9154

Commonwealth of Massachusetts

William F. Weld
Governor

Argeo Paul Cellucci
Lieutenant Governor

James J. Kerasiotes
Secretary and MBTA Chairman

Patrick J. Moynihan
MBTA General Manager

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EXECUTIVE SUMMARY

Introduction

The Massachusetts Bay Transportation Authority (MBTA) proposes to restore the Worcester-Boston commuter rail service discontinued in 1975 ("the Worcester Extension project" or "the project"). In August 1992, the MBTA submitted to the Secretary of Environmental Affairs ("the Secretary"), under various provisions of the regulations for the Massachusetts Environmental Policy Act (MEPA) which she administers, an Environmental Notification Form (ENF) on the Worcester Extension project. A project's ENF is the basis on which the Secretary determines whether it requires further environmental review. In October 1992, the Secretary determined that the project required an Environmental Impact Report (EIR), a full study of the project's impacts and of mitigation for those impacts. That same month, the MBTA agreed that the project would be reviewed under MEPA as a Major and Complicated project, with a Special Procedure for the MEPA review. The Special Procedure contemplated a comprehensive Draft EIR (DEIR) on the whole project, at about a 30% design stage, and then either a single Final EIR (FEIR) on the project, or FEIRs on various project elements, all FEIRs to be at about a 60% design stage. The Special Procedure established a Citizens Advisory Committee (CAC) to assist the Secretary with the project's MEPA review. The MBTA, in accordance with the provisions of the Special Procedure, submitted a Notice of Project Change to develop two separate FEIRs on the Project: the first to include a comprehensive review of the impacts associated with the Railroad Right-of-Way (track and signal work) and Layover Facility; the second, a review of Commuter Rail Stations and Railroad Operations. The Secretary concurred with this approach in the Certificate on the Notice of Project Change dated June 22, 1995. The first FEIR covering the Railroad Right-of-Way and Layover Facility was submitted in July 1995. More recently, another Notice of Project Change requested that the second FEIR, to cover Commuter Rail Stations and Railroad Operations, be prepared as two separate FEIRs--the first to cover the Millbury Station, Grafton Station and Railroad Operations, and the second to cover the Westborough, Southborough and Ashland Stations. The Secretary concurred with this approach in the Certificate on the Notice of Project Change dated January 10, 1996.

What follows is an Executive Summary of the MBTA's Worcester Extension Project FEIR for the Millbury Station, Grafton Station and Railroad Operations. It includes a summary of the overall project, including the project background, project need, financial feasibility and project elements, plus a summary of the environmental impacts and proposed mitigation for the construction and operation of Millbury and Grafton Commuter Stations and the effects of commuter rail operations without stations in Westborough, Southborough and Ashland. The traffic impacts and proposed mitigation for the Framingham Station are included also. This second FEIR will go through a period of public comment, after which the Secretary will determine its adequacy. If this FEIR is determined to be adequate, the third FEIR covering Westborough, Southborough and Ashland Stations will then follow, in accordance with the Special Procedures and the Secretary's Certificate on the Notice of Project Change dated January 10, 1996.

Project Background

The overall project supports two interrelated public policy goals, reducing traffic congestion on the Massachusetts Turnpike (I-90) and in downtown Boston and improving air quality for the Boston metropolitan region.

Traffic congestion has been a complicated public policy question for the Boston metropolitan area for decades, as it has been for most American cities. The same causes underlie this question for all older cities like Boston: increasing automobile use per capita; residential suburbanization; and the continued viability of the downtown business core as a preferred employment location for the myriad of specialized services needed by the entire metropolitan area. The same solution has been tried in most cities: expanded center-suburb highway capacity. Locally, this solution is reflected in the 1948 Master Highway Plan for the Boston Metropolitan Area, which became, for the next 20 years, the work plan on the basis of which much of the center-suburb roadway capacity now in place in metropolitan Boston was put in place. By the late 1960s, however, the limits of this solution were becoming clear. Citizen activists and progressive transportation experts increasingly opposed the landtakings and neighborhood disruption new center-suburb highway capacity would entail, particularly since the demand for that new capacity appeared, from the perspective of the times, insatiable.

On the basis of the technical conclusions of the Boston Transportation Planning Review in the early 1970s and the continued political pressure from activists opposing highways, Governor Francis Sargent began the forging of new transportation priorities for metropolitan Boston based on improved public transportation. The planning, construction and operation of this revitalized system has been the job of the metropolitan

Boston area's public transportation manager, the MBTA. Federal initiatives have complemented the state's initiatives, most recently the Intermodal Surface Transportation Efficiency Act (ISTEA) enacted in 1991. A relatively brief surge in federal transit assistance was enjoyed by the states in the 1970s as well. Since the early 1970s, a number of important new MBTA projects have been placed in operation to serve downtown Boston, both from within the city and from its inner suburbs inside Route 128, and from the outer suburbs beyond Route 128 as well. All the new service for downtown Boston from the outer suburbs involved revitalizing existing commuter rail lines and, later, extending these lines out to the expanding edge of the Boston employment market. The Worcester Extension project is part of this program, which also includes, among others, service extensions to Newburyport on the North Shore and to several locations on the South Shore using restored Old Colony corridors. With the completion of the Worcester, Newburyport, and South Shore commuter rail projects, the MBTA's extension program will be largely completed. Figure ES-1 shows all the MBTA's existing and planned commuter rail lines, including the Worcester Extension project.

While center-suburb traffic management was one driving force behind the vast program of MBTA public transportation improvements now nearing completion, air quality in the Boston metropolitan area also is an important concern. This is particularly the case since passage of the 1990 amendments to the Clean Air Act. The 1990 Clean Air Act amendments placed all the states whose ambient air quality did not meet federal standards in 1990 on strict timelines, longer for states with more serious problems, for meeting and thereafter maintaining those standards. By 2007 California, the only state with what the 1990 amendments classified as "extreme" air quality problems, must comply with all the federal standards. Massachusetts, whose problems are classified as "serious," must comply by 1999. The chief Massachusetts problem is ozone, whose precursors, volatile organic compounds (VOCs) and oxides of nitrogen (NO_x), must be reduced about 25% from present levels of in-state generation. The penalties for non-compliance include possible loss of federal highway funds and reclassification into the next highest category of Clean Air Act air quality, "severe." Reclassification under the 1990 amendments would impose additional air quality control burdens that could constrain economic development in Massachusetts seriously.

Massachusetts' air has been getting cleaner for the past 15 years. But as the traditional target of clean air strategists, "stationary sources" of air pollution like industrial smokestacks or electric power plants, have either reduced emissions because of improved control technologies or gone away because of economic changes, increased attention has been given to "mobile sources," chiefly automobiles, as a major source of air contaminants. For even as individual new automobiles, because of the effect of more stringent federal standards, operate with fewer and less toxic emissions, there are more

MBTA Commuter Rail System Extensions

Massachusetts Bay Transportation Authority

COMMUTER RAIL LINES

FIGURE ES-1

cars on the road than ever before, and the average annual mileage driven per car is rising. In metropolitan Boston, several factors are behind this expanded automobile use. These include continued residential suburbanization, to the areas between Route 128 and I-495 and now even beyond; a newer phenomenon of increasing employment growth outside downtown Boston at major highway intersections and interchanges; and, perhaps undergirding these both, dramatic new wealth: between 1970 and 1990 Massachusetts, per capita, went from being among the poorer to among the richest of the U.S. industrial states. Together, those factors threaten the ability of Massachusetts to achieve and maintain the National Ambient Air Quality Standards.

Every state under a Clean Air Act timeline must have a plan, called a State Implementation Plan or SIP, for timely meeting the federal standards. The plan represents that state's allocation of the relative burdens of further improvements in air quality. Because so much progress already has been made in Massachusetts in making stationary sources cleaner, much of the remaining burden of meeting the 1999 deadline will fall on mobile sources. And while mandatory federal auto emission standards, along with the Commonwealth's decision to adopt even tougher voluntary low emission vehicle standards, will mean increasingly cleaner cars on the state's roadways, only by limiting the growth in overall auto travel can Massachusetts ensure that it will achieve and maintain clean air standards. A clear means to this reduction is an efficient public transportation system. And so the Massachusetts SIP contains extensive commitments to keep operating virtually all existing MBTA services and to start operating several additional MBTA services in Boston itself and throughout the metropolitan area. Among the planned services included in the SIP are the unfinished commuter rail projects just discussed, including the Worcester Extension project, which is to be operational by December 31, 1996, unless infeasible due to adverse engineering, environmental, or economic impact.

Thus, the MBTA's rebuilding of metropolitan Boston's public transportation system, which began in the 1970s as an alternative to road building for combating traffic congestion, is nearing completion in the 1990s with another central goal to serve: helping Massachusetts to meet federal air quality standards by 1999, and to maintain them thereafter. The Worcester Extension project will serve both goals.

Project Need

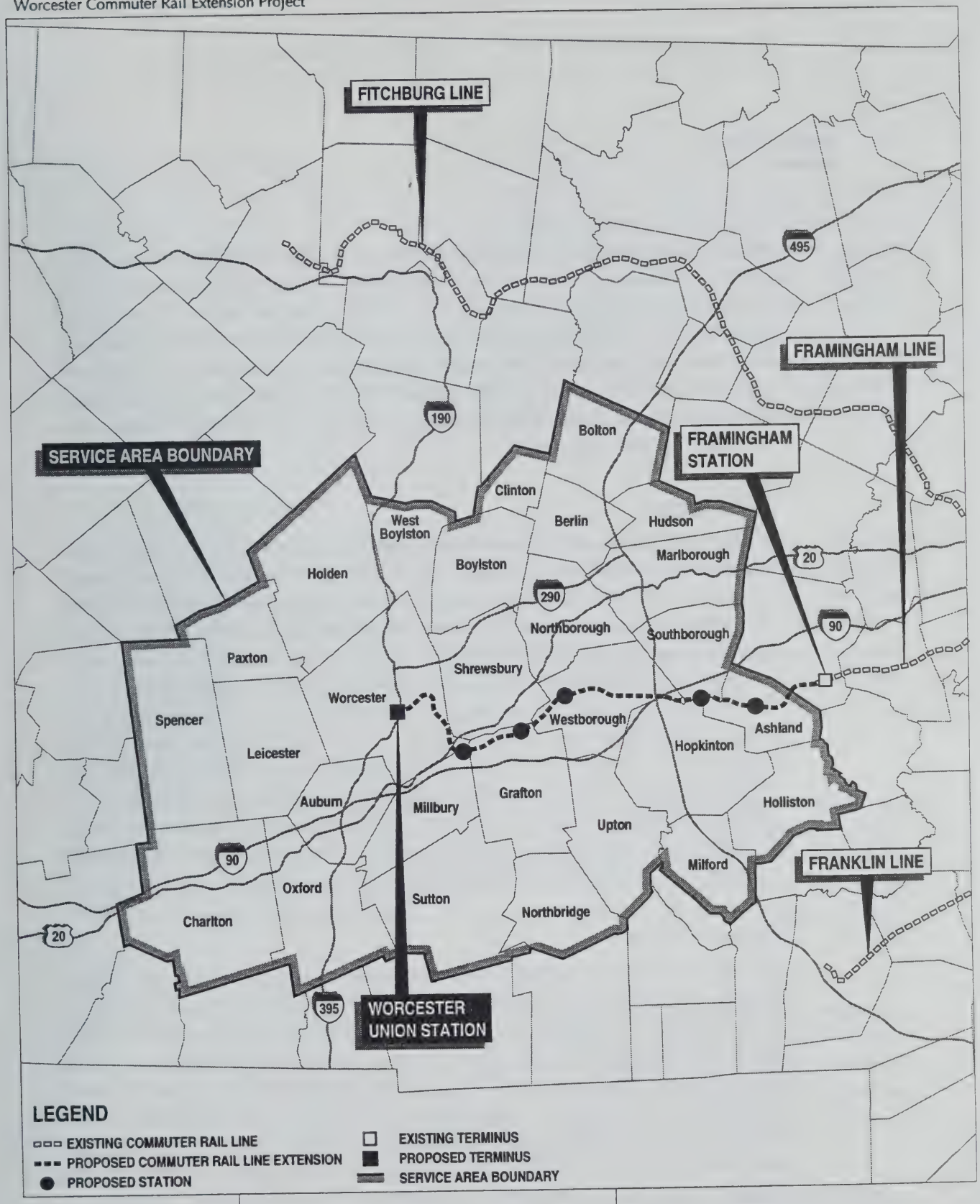
The Worcester Extension project will play an important part of the Commonwealth's overall strategy for reducing traffic congestion in downtown Boston and improving air quality for the Boston metropolitan region by providing a reliable public transportation

alternative to the rapidly growing number of commuters to Boston from communities west of Boston near and beyond I-495 whose numbers will increasingly test the capacity of existing radial highways carrying commuters to and from Boston, especially the Massachusetts Turnpike.

Local rail service between Worcester and Boston ran continuously between 1835 and 1975, and freight and intercity passenger service runs to this day. Particularly after World War II, increasingly widespread automobile use led to increasing suburbanization, and to an extensive highway building program in the Boston metropolitan area, as throughout the Nation. The chief elements of Boston's existing rim-and-spoke highway system began with the construction of Massachusetts Route 128 (now also, in large part, I-95) in the mid-1950s and were in place by the mid-1960s with the completion of the Massachusetts Turnpike Extension from Weston to Boston. Increasingly easy automobile travel to downtown Boston, eased in part by an increasing shift of overall employment to locations outside Boston, led to widespread declines, throughout Boston as throughout most of the Nation's metropolitan areas, in commuter rail usage, and to declines as well of existing railbeds, stations, rolling stock and equipment.

Nonetheless, the continued movement of population out of Boston proper has not been matched by a decline in employment in the downtown Boston area. Instead, employment in downtown Boston has continued to grow strongly and is expected to continue to grow steadily in the coming decades. It is the interaction between these two phenomena--continued residential suburbanization and continued strong job growth in downtown Boston--that is the driving force behind the Worcester Extension project and MBTA extension projects to Newburyport and the South Shore. The demographics, which by 1975 had led to low patronage for Worcester/Boston commuter rail service, have changed dramatically less than 20 years later.

The MBTA estimates that patrons for the Worcester Extension service will be drawn from towns whose centroids are approximately six miles or fewer from the rail line, and from not much beyond ten miles from the rail line. This comprises 28 communities, illustrated on Figure ES-2, which the MBTA projects will form the core service area for the Worcester Extension project. In these 28 communities, population increased only 8 per cent between 1980 and 1990, but the work force has grown 23 per cent, and work trips to Boston proper and to Cambridge have increased, respectively, 72 per cent and 151 per cent. Large real increases between 1980 and 1990 are involved, moreover. Altogether, the 28 service area communities generated just over 6,000 work trips to the Boston area in 1980, and some 11,000 work trips in 1990. The Worcester Extension project aims to capture approximately 2,100 riders in 1996, 2,300 riders in 2001, 2,500 riders in 2006, and 2,700 riders in 2011.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 6 Miles
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PROJECT SERVICE AREA

FIGURE ES-2

Project Elements

Overview

The Worcester Extension DEIR addressed the four key physical elements of the project: corridor upgrading and track improvements; five intermediate stations; a layover facility for staging morning inbound trains; and an interim Worcester station. The first FEIR addressed the environmental impacts and mitigation related to corridor improvements and construction of the layover facility. This FEIR addresses construction of commuter rail stations in Millbury and Grafton and implementation of Basic Service (20 trains each weekday) to those stations. Stations at Westborough, Southborough and Ashland will be the subject of a subsequent FEIR.

Corridor Upgrading

Existing commuter service between Boston and Framingham operates on tracks owned by the MBTA. (Conrail also uses these tracks.) The new Worcester service will operate on the Conrail mainline between Framingham and Worcester. Significant improvements on this mainline are needed to accommodate both existing Conrail freight and Amtrak intercity service and the new Worcester service. About four miles of eastbound track in Worcester will need upgrading. This section of track is used as siding/storage track by Conrail. This storage capacity, will be replaced by the construction of 1.4 miles of new siding along the main line immediately west of Union Station in Worcester. Double tracks will be restored over about seven miles through Millbury, Grafton and Westborough, however the roadbed is generally in adequate condition to allow this restoration. Additional track and signal work will be undertaken throughout the corridor to accommodate the additional train operations. Construction on the track improvements commenced in the fall of 1995 and will be completed by mid 1996.

Intermediate Stations

The MBTA's ridership estimates have assumed the construction of five intermediate stations. The DEIR proposed stations for Millbury, off either Route 122 opposite Exit 11 of the Massachusetts Turnpike or off Route 20 in Worcester; for Grafton, off Pine Street near Route 30; for Westborough, off Smith Valve Parkway; for Southborough, at Route 85 and Southville Road; and for Ashland, either off Pleasant Street and Route 135, or off High Street and Route 135. Comments on the DEIR and continued input received through the CAC, rail advisory committees and town officials determined that siting and other issues precluded finalizing the stations in Westborough, Southborough and Ashland. The MBTA requested through a Notice of Project Change, permission to proceed with a FEIR for Millbury and Grafton Stations.

Layover Facility

The proposed layover facility is an existing railyard in Worcester. It is proposed for the outer terminus of the Worcester line, near where trains will end each day's service and will be needed to begin each day's service. (Trains originating in Boston would provide morning service to Worcester.) The proposed layover facility can accommodate four train sets with necessary support facilities. Wayside power will be provided to limit the amount of locomotive idling required, particularly during cold weather. This site is located in an active rail area with primarily non-sensitive adjacent land uses. The impacts of the layover facility were addressed in the first FEIR, circulated in July 1995. Construction commenced in the fall of 1995, and the facility is expected to be operational by September 1996.

Worcester Station

The existing Amtrak station in downtown Worcester, north of the railroad tracks, has been modified and expanded so as also to serve as an interim station. Eventually, Worcester passengers will use a redeveloped Union Station, about 700 feet west of the Amtrak station. The redevelopment of Union Station, jointly by the Worcester Regional Transit Authority and the Worcester Redevelopment Authority, has undergone separate MEPA review under EOEA #9521. Union Station's opening currently is planned for early 1998.

Operations

The MBTA began interim Worcester Extension service, express between Worcester and Framingham, on September 26, 1994. Service is weekdays only, three trains inbound during the morning commute and three trains outbound during the evening commute. Basic Service of 10 inbound trains and 10 outbound trains each workday is scheduled to begin by December 1996, with service to Worcester, Millbury and Grafton Stations.

Millbury Station

The Draft EIR presented two alternative station sites in Millbury, both proposing parking for 300 vehicles. The location of station platforms is very similar for both alternatives. The major difference between the alternatives is that one provided parking south of the tracks accessed by a new roadway connecting to Route 122 opposite the Turnpike Exit 11 in Millbury, while the other alternative provides parking on the north side of the tracks accessed by a new road connecting to Route 20 in Worcester.

With input from the Citizens Advisory Committee, the Millbury Commuter Rail Advisory Committee, and consideration of comments received on the Draft EIR, the MBTA has

designated the Route 20 access alternative as the proposed Millbury Station site. Recently, the MBTA has received a number of comments and other expressions of concern from the City of Worcester and residents of the Flint Pond subdivision located to the north of the proposed station site. There does not appear to be any substantial negative effect on this neighborhood. Even so, the MBTA is working with the City of Worcester and the neighbors to explore ways further of limiting any perceived effects.

The proposed project plans to construct five intermediate stations between Worcester and Framingham. As an interim condition, Millbury and Grafton stations will be constructed in 1996 pending resolution of issues relating to implementation of the other three stations in Westborough, Southborough, and Ashland.

If all stations were to be in service in 1996, Millbury is projected to attract 149 patrons per day. Under the five station scenario, ridership would increase to 162 patrons in 2001. During the interim, when stations in Westborough, Southborough, and Ashland are not yet in service, Millbury ridership is estimated to be 161 people a day in 1996.

The Millbury station will be constructed on a vacant, wooded tract of land in the extreme northerly corner of town, north of the railroad and just west of the former Millbury Junction.

The access drive will be a new 3,000 foot long roadway, beginning at a new intersection on Route 20 opposite the Big Y shopping center entrance. The westerly end of the station driveway will traverse industrial property. The location of the roadway has been designed to minimize effects on truck access to the businesses, and no buildings will be acquired.

Near the Worcester City line, the access road traverses one house lot of a recent expansion of an existing residential subdivision. A new street, which was constructed in 1995, has not yet been paved, and the impacted lot is vacant.

The proposed access road will be 26 feet wide. Paved shoulders will be provided to accommodate bike riders and the occasional pedestrian. The intersection of the access road and Route 20 will be signalized and the new signal coordinated with the existing signal at Route 20 and Sunderland Road.

The station layout includes paved parking for 300 vehicles, two 800-foot long low-level access boarding platforms including two 45-foot long raised access platforms for the disabled, a passenger drop-off area, a pedestrian bridge over the tracks with stairs and ramps, station canopy, site lighting, landscaping and bike racks. Intertrack fencing will be installed to discourage pedestrian crossing of the tracks.

Grafton Station

The proposed commuter rail station in Grafton, with parking for 265 vehicles, will be constructed west of Pine Street and North of Westborough Road (Route 30) and the railroad tracks.

If all five intermediate stations were open in 1996, the Pine Street station is projected to attract 116 patrons with daily ridership increasing to 149 by the year 2011. Under the present timetable, only Millbury and Grafton Stations will be placed in service by the end of 1996, resulting in a short-term ridership of 216. The increase is primarily patrons who would have used the Westborough Station. Station generated traffic is not expected to result in any significant impact on existing levels of service for local streets. During construction, short-term noise and vibration impacts could occur at two residences on Route 30.

The station site construction will displace wetland resources, in addition to work within the buffer zone. A detention pond is proposed to maintain stormwater discharge flows at or below existing conditions. All work affecting resource areas will be coordinated with the Grafton Conservation Commission.

The proposed Grafton Station will be constructed on a vacant tract of land located north of the railroad tracks and west of Pine Street. The land, formerly part of the Grafton State Hospital property, was owned by the Commonwealth of Massachusetts Division of Capital Planning and Operations, and the stations site was set aside for MBTA use. Transfer of ownership has been completed.

The station will provide parking for 265 vehicles, with a new access drive to be constructed to connect to Pine Street, just north of the railroad. The Station will include two 800-foot, low level boarding platforms; two 45-foot, long high-level access platforms for the disabled; an overhead pedestrian bridge with ramps and stairs, passenger drop-off area, station canopy, site lighting, landscaping, and bike racks. Intertrack fencing will be installed to discourage pedestrian crossing of tracks.

The Grafton Station site currently has only a single track on the north side of the rail bed. This track will be refurbished, and a new second track installed, 14 feet on centers, on the southerly side of the railbed. This work, presently under construction, was described in the Track and Layover FEIR circulated for review in July 1995.

The Massachusetts Highway Department will be reconstructing the Pine Street bridge over the railroad as well as the Pine Street approaches and the intersection with Route 30 as part of the Department's ongoing substandard bridge replacement program. Design of the new bridge has allowed for the proposed station elements where necessary; for

example, bridge piers are set back to accommodate passenger platforms under the bridge. The Pine Street bridge construction will begin in the spring of 1996.

The Worcester Business Development Corporation has been preparing conceptual design plans for an industrial park development on Pine Street northerly of the proposed MBTA Station. This project is intended to attract bio-tech business to the site, to be developed for a several year period. The CenTech Park project is undergoing MEPA review (EOEA No. 8798).

The traffic analyses performed for the Grafton Station include future growth resulting from the CenTech Park project. The proposed geometrics for the Pine Street/Route 30 intersection have been designed to accommodate both commuter rail and anticipated bio-tech park traffic.

Project Alternatives

Overall Alternatives

In addition to "No Build," which forms the standard environmental baseline against which a project's impacts are assessed, the MBTA, in its DEIR, considered the public transit alternative of express bus service designed to be roughly equivalent to the project's service for its projected ridership. The key comparisons were around air quality impacts and costs, capital and operating. This FEIR addresses the economic impact of the Worcester Extension Project and demonstrates the Project's financial feasibility for the overall MEPA review.

Project Socio-Economic Impacts

In its DEIR, the MBTA has reviewed several concerns expressed by observers about the Worcester Extension project's possible socio-economic impacts. Among these have been land use impacts in the service area, impacts on local revenues and local property values in communities with stations, and changes in existing MBTA assessments or their possible imposition on service area communities not now in the MBTA district. In general, the Worcester Extension project is not expected to have a significant impact on any of these areas of concern.

Project Environmental Impacts and Mitigation

In its DEIR, the MBTA comprehensively analyzed all the project elements in the following impact areas: traffic; air quality; noise and vibration; site drainage; wetlands and wildlife; historic sites; archaeological resources; visual impacts; hazardous materials; pedestrian safety; and construction. In this FEIR, the primary focus is on the impacts of Millbury and Grafton stations and implementation of Basic Service to those stations. Corridor impacts have been revisited in the areas of air quality, noise and vibration to update changed train speeds of 60 mph maximum and to address the temporary effects in Westborough, Southborough, and Ashland that result from trains not stopping at stations in those towns.

MEPA requires that the impacts from projects, whether public or private, be identified, minimized, and mitigated where feasible and where the project is the cause of unacceptable impacts. Not all impacts from a project require mitigation. The MBTA understands there are various local proposals for mitigation, but emphasizes that, since the Worcester Extension project is itself a required air quality mitigation measure under the Massachusetts SIP, its mitigation should be as focussed as possible on setting off impacts clearly traceable to the project. The MBTA continues to evaluate mitigation associated with the operations of the Worcester Extension Project as well as the construction and use of the proposed intermediate stations.

Impacts of Basic Service Operations

With the opening of stations at Millbury and Grafton, scheduled for December 1996, the MBTA will begin Basic Service to those stations consisting to 10 outbound and 10 inbound trains each weekday. The impacts of Basic Service have been addressed for future service to all stations and for an interim short-term condition of service to Millbury and Grafton only (in addition to Worcester).

Air Quality

The air quality analyses evaluated the regional impacts of rail service in three components--the effects of auto trip diversion to commuter rail, the effects of improved highway operations resulting from reduced peak hour volumes, and the effects of additional train operations. The reduction in VMT resulting from diversion of auto trips and the improved efficiency of peak hour flows on the Massachusetts Turnpike far outweigh the impacts of additional train operations. Extension of commuter rail operations to Worcester will result in reductions of regional emissions of VOC, NO_x and CO. The greatest reduction occurs in 1996, as reduced emission rates for vehicles in later years have reduced benefit compared to existing emission rates.

Noise and Vibration

For Basic Service to all station, there will be noise impact on a total of seven residential houses. Under service to Millbury and Grafton only, trains will not stop in Westborough, Southborough, and Ashland, resulting in higher operation speeds in those communities. Although the impact distance will be somewhat greater, there are no additional residences impacted.

The only area of concentrated noise impact is at a group of houses just east of Route 140 in Grafton where train speeds approach their upper limits. Other noise impacts identified along the right-of-way consist of mainly of scattered residential land uses situated very close to the tracks.

A preliminary analysis of the area east of Route 140 in Grafton suggests that construction of a 500-foot barrier along the south side of the tracks would be feasible. The barrier would provide a significant noise reduction for some of the homes on Westborough Road. Present L_{dn} with Conrail and Amtrak trains is about 70 dBA fifty feet away from the tracks. Basic Service is expected to raise this level to about 75 dBA. An 8-foot high barrier would lower the L_{dn} to 65 dBA, at a cost of approximately $80,000, which falls well within the MBTA's price criterion for cost effectiveness. The track side of the barrier would be treated with sound absorbing material to prevent reflected sound from impacting residences on the north side of the railroad.

For the two isolated residences, (one in Westborough and one in Grafton) the cost of a 200 foot long barrier (the minimum length to provide a 10 dBA reduction of individual train noise) would be approximately $64,000 per installation. In each instance, the barrier does not meet the $2,400 per dB/dwelling criterion for economic reasonableness.

Previous vibration analyses in the DEIR and first FEIR were based on maximum MBTA train speeds of 70 mph and freight speeds of 50 mph. Due to changed project criteria, maximum speeds will now be limited to 60 for commuter rail and 40 for Conrail. A revised analysis has been performed, and also addresses the interim conditions of service to Millbury and Grafton only.

The revised train vibration evaluation projects a total of 15 residential vibration impacts for the proposed Basic Service to all stations, and 23 residential units for Basic Service to Grafton and Millbury only. The analysis also indicates that the primary areas of impact are expected to be where train speeds approach their upper limits.

All of the impacts identified are as a result of absolute impact incurred by MBTA commuter trains. All of the significant vibration impacts reflect annoyance or activity interference effects associated with indoor vibration and not building or structural

damage. *In no cases do the projected train vibration levels exceed the vibration damage criteria along the corridor.*

Equipment maintenance and ballast mats are probably the most proven and practical means of providing mitigation from vibration impact. However, it is highly unlikely that ballast mats will be effective in controlling the low-frequency dominated vibration generated by the MBTA commuter rail trains. In addition, this project would require the installation of ballast mats under several miles of already existing track, requiring an extensive retrofit. Since the end result would be a reduction of only a few decibels, ballast mats are not a cost-effective option for this project, and will not be used.

The only practical option for minimizing vibration impact to the community, therefore, is through a regular maintenance program of the wheels and trackbed. This will entail regular inspection and continued upkeep of the wheels and trackbed in good condition. However, even with such practices some residual vibration impact due to this project may be unavoidable once Basic Service operations are underway. While the vibration due to introduction of Basic Service will be noticeable at the Cherry Street residences in Ashland the increase in vibration is only temporary and will fall to acceptable levels under Basic Service to all stations. Therefore, it is not cost effective to consider mitigation for these residences.

Archaeological and Historical

Due to the unusually cold weather and record snowfall this winter, the architectural survey along the right-of-way and archaeological investigations of proposed fencing locations and of the Millbury Station site could not be completed in time for this filing. However, because substantial progress nonetheless has been made, this FEIR describes historic and archaeological impacts to the extent that they are known. Further, it includes a Memorandum of Agreement (MOA) between the MBTA and Massachusetts Historical Commission which identifies commitments from the MBTA to complete the survey work as well as mitigation contingencies which are acceptable to both agencies. Thus, the MOA, which is subject to revision based on comment on this FEIR, will enable the MBTA to meet its obligations under M.G.L. Chapter 30, Section 61 with regard to outstanding right-of-way and Millbury Station historic and archaeological issues.

Impacts of Millbury Station and Grafton Station

The analysis of potential impacts of building and operating the stations address traffic, air quality, noise and vibration, wetlands and drainage, historic and archaeological resources, visual, hazardous materials, pedestrian safety and short-term construction impacts.

Impacts of Millbury Station

Traffic analyses evaluated 1992 existing conditions, 1996 Build and No Build conditions (including scenarios of building all stations, building Millbury only and building Millbury and Grafton only) and 2001 Build and No Build. Analyses were performed for signalized and unsignalized intersections and roadway segments affected by station traffic. No significant adverse traffic impacts were identified, except for the proposed access road intersection at Route 20. To mitigate impacts of the new intersection, a traffic signal will be installed. This intersection will operate at acceptable Level of Service in 1996 and 2001.

The signalized section of Route 122 and Turnpike Exit 11 was selected as representative of the worst case location for analysis of micro-scale air quality. While Build levels are marginally higher than No Build, the calculated 1-hour and 8-hour CO levels are well below the allowable maximums, and no violation of air quality standards will result from Millbury Station traffic.

Millbury Station will not result in any noise or vibration impacts from either construction or operation of the station.

The station and access road have been sited to avoid direct impact on any wetland resources. A detention pond will be constructed to maintain runoff volumes at existing peak discharge levels. A Notice of Intent will be filed with the appropriate Conservation Commissions, and the MBTA will comply with any Orders-of-Conditions issued.

No potentially historic properties are located near the Millbury Station. The intensive archaeology survey has been delayed due to the severe winter weather. Completion of the survey is addressed in the Memorandum of Agreement between the MBTA and MHC.

The station will have little visual impact. Landscaping treatment will enhance the existing vegetative screening that buffers the adjacent residential subdivision in Worcester.

An environmental site evaluation of the station site was performed to address M.G.L. Chapter 21E. A comprehensive subsurface exploration program for the site is in progress and will be completed prior to final design of the station.

Although no pedestrian traffic to Millbury is forecast, the access road will provide wider shoulders to accommodate occasional walkers and bicyclists. Bike racks will be provided at the station platform area.

Impacts of Grafton Station

Analysis indicates that the addition of traffic volumes attributable to the proposed Grafton Station will not result in any significant adverse impacts on the roadways considered in this report. For both years 1996 and 2001, the analysis shows no significant change in levels of service for the signalized and unsignalized intersections and the roadway segments. The same applies to 1996 Millbury/Grafton Only, where impacts are insignificant.

The intersection of Route 140 and Route 30 was selected as representing the worst case for micro-scale air quality analysis. The predicted Co concentrations are the same or nearly the same for the "No Build" and "Build" conditions, for both the 1-hour and 8-hour periods. All values are well below the 35 ppm for the 1-hour standard and 9 ppm for the 8-hour standard.

No noise impacts were identified for Grafton Station. The station will displace approximately 850 s.f. of wetlands, to be replicated by 1,300 s.f. All work affecting resource areas will be addressed in a Notice of Intent to be filed with the Grafton Conservation Commission.

The project will implement Best Management Practices (BMPs) in order to minimize and mitigate any stormwater related impacts created by the proposed project. BMPs will include a parking lot sweeping program and catch basins equipped with sumps and oil and grease traps.

The proposed stormwater management system for the station includes a stormwater detention pond to mitigate any increase in peak flow rates generated by the station. The detention pond will be sized to accommodate stormwater runoff generated by storms up to and including the 100 year event.

The site of Grafton Station is located within the boundaries of the Grafton State Hospital National Register District. The potential impacts of the station are primarily visual. The proposed use of landscaping and selection of appropriate materials and design elements will maintain the visual integrity of the station in relation to its surroundings.

The intensive archaeological investigation yielded no significant archaeological resources on the site. Site investigations revealed no significant issues relating to hazardous materials.

Framingham Station

By a Certificate on Notice of Project Change filed November 30, 1995, this FEIR addresses traffic and parking issues at Framingham Station.

Interim Service, which added 2 new stops at Framingham Station offering express service to Boston, has proven to be popular, attracting approximately 400 new riders to the station. This additional patronage has added to traffic congestion and increased competition for limited parking resources.

The MBTA has evaluated traffic impacts on two existing signals on Route 126 north and south of the grade crossing at the Framingham Station, and has committed to installation of new signals at both locations that will enhance traffic operations and reduce delays.

At present, station patronage results in a parking demand that exceeds the available supply. Proposed improvements at the station will add nearly 100 spaces. When the additional stations at Westborough, Southborough, and Ashland come on line over the next few years, Framingham station ridership will decrease by nearly 50 percent, and station parking demand will be reduced accordingly.

Public Participation

The MBTA has, for some time, been consulting with the rail committees constituted by the Board of Selectmen in each town (other than Grafton, whose Board of Selectmen remained directly involved in the station site selection process) to assess station locations and recommend a preferred location. Periodically, the MBTA and its project consultants have met with these committees to bring new information about the project analyses underway, or to field questions about project concerns that had surfaced in each locality where a new intermediate station was planned. The MBTA has found these meetings uniformly valuable.

As part of the Special Procedure created for the review of the Worcester Extension project, the Secretary created a Citizens Advisory Committee (CAC). Each local rail committee has a CAC member and others were chosen after a nomination process conducted by the Secretary. The CAC membership has recently been expanded to include representation from Hopkinton and Framingham. The CAC has an overview role with respect to the project, and also certain rights under the MEPA regulations, including the right to 30 days' advance review of the FEIR, the right to request changes in the FEIRs, and the right to have its comments circulated with the FEIRs if timely filed with MEPA.

The MBTA has met periodically with the CAC and has gained valuable insights about the project from CAC members.

FEIR CIRCULATION LIST

Federal

Department of the Army
  Corps of Engineers, New England Division
Department of the Interior
  Fish and Wildlife Service, N.E. Region
Environmental Protection Agency
  Region 1, Environmental Review Office

State

Executive Office of Communities and Development
  State Clearinghouse
Executive Office of Consumer Affairs
  Department of Public Utilities
Executive Office for Environmental Affairs
  Department of Environmental Management
    Division of Resource Conservation (Inland ACEC Program)
  Department of Environmental Protection, Boston Office
    Division of Waste Site Cleanup
    Division of Watershed Protection
  Department of Environmental Protection, Central Regional Office
    Division of Wetlands and Waterways
  Department of Environmental Protection, Northeast Regional Office
    Division of Wetlands and Waterways
    Division of Water Pollution Control
  Department of Fisheries and Wildlife and Env. Law Enforcement
    Division of Fisheries and Wildlife
    Massachusetts Natural Heritage Program
  Department of Food and Agriculture, Lancaster Regional Office
    Bureau of Land Use
Executive Office for Transportation and Construction
Massachusetts Highway Department, Boston Office
Massachusetts Highway Department, District #3
Massachusetts Historical Commission
Massachusetts Architectural Access Board

State (cont.)

Massachusetts Water Resources Authority
State Transportation Library

Elected Officials

U.S. Congressman Peter Blute
State Senator Matthew J. Amorello
State Senator Arthur E. Chase
State Senator Robert A. Durand
State Senator David P. Magnani
State Senator Robert D. Wetmore
State Representative John J. Binienda
State Representative Stephen M. Brewer
State Representative Harriette L. Chandler
State Representative William Constantino, Jr.
State Representative Barbara Gardner
State Representative William J. Glodis, Jr.
State Representative Emile J. Goguen
State Representative Barbara Gray
State Representative Paul Kollios
State Representative William J. McManus, II
State Representative Kevin O'Sullivan
State Representative Vincent A. Pedone
State Representative George N. Peterson
State Representative John A. Stefanini

Regional Agencies

Central Massachusetts Regional Planning Commission
Metropolitan Area Planning Council
Worcester Regional Transit Authority

City of Boston

Environment Department
Transportation Department
Redevelopment Authority
Public Library

City of Worcester

Mayor's Office
City Manager
City Council
Conservation Commission
Planning Board
Office of Planning and Community Development
Department of Traffic Engineering
Redevelopment Authority
Public Library

Town of Millbury

Board of Selectmen
Commuter Rail Study Committee
Conservation Commission
Planning Board
Public Library

Town of Grafton

Board of Selectmen
Conservation Commission
Planning Board
Grafton Water District
Commuter Rail Study Committee
Public Library

Town of Westborough

Board of Selectmen
Commuter Rail Study Committee
Conservation Commission
Historical Commission
Planning Board
Recreation Department
Town Engineer
School Committee
Town Coordinator
Police Department
Public Library

Town of Southborough

Board of Selectmen
Commuter Rail Study Committee
Conservation Commission
Planning Board
Public Library

Town of Ashland

Board of Selectmen
Conservation Commission
Planning Board
Commuter Rail Study Committee
Town Manager
Town Planner
Public Library

Town of Framingham

Board of Selectmen
Conservation Commission
Planning Department
Public Library

Town of Hopkinton

Board of Selectmen
Conservation Commission
Planning Board
Public Library

Town of Wellesley

Board of Selectmen

City of Newton

Department of Planning and Development

Citizens Advisory Committee

Mr. David C. Robbins, Chairman
Mr. Ed Bates
Mr. Robert Gentile
Mr. Dex Malone
Ms. Kathleen Bartolini
Ms. Patricia Murphy-Capone
Mr. Wayne Thies
Mr. Stephen Doret
Ms. Judith McCabe
Mr. Michael O'Bryan
Mr. James R. Waterman
Ms. Lydia Bogar
Mr. John A. Reil
Mr. Edward J. Ropiak
Ms. Margaret A. Lavallee
Mr. Frederick Moseley
Senator Matthew J. Amorello
Mr. Jeffery Dore
Mr. Stephen Bishop
Ms. Mary MacAdam
Mr. David S. Goldman
Mr. Andrew Boyce
Mr. David Holbrook
Mr. Shaun Finnegan
Mr. Frank Healy
Mr. John Stasik
Mr. William J. Christensen
Mr. Mark W. Davis

Private Groups/Others

Massachusetts Audubon Society
Metrowest Growth Management Committee
Massachusetts Restaurant Association
Bicycle Coalition of Massachusetts
Preservation Worcester

Private Groups/Others (cont.)

Union Station Alliance
Worcester Area Chamber of Commerce
Worcester Business Development Corp.
Tufts University School of Veterinary Medicine
Worcester Telegram and Gazette
Conrail
Peter Pan Bus Lines, Inc.
Cavalier Coach Corporation
Gulbankian Bus Lines
MBTA Advisory Board
MASCO
Association for Public Transportation, Inc.
Joint Regional Transportation Committee
People for Ashland West Alternative
William and Helen Panas
Joseph Orlando
Louis and Maureen Jankauskas
Robert, Barbara, and Marie Brais
Lawrence Gomes
Cheryl and Paul Crivello
Dorothy McMahon
Elizabeth Colbert
Andrew & Teresa Boyce
Scott Rossiter
John Woodward
Andrew B. O'Donnell
Brennan F. Wall
Mary Fisher
Mary Cullen
Stephen & Charlene Henry
Brian & Antoinette Kennedy
Mario Avelloni
E. Thomas & Judith McCabe
Sally Tajiani
Janice & Allen Silvestry
Rosemary Johnson
Diane Power
Dennis Cox
Jacqueline & David Cox
Dorothea MacLeod
Marvin Silver
Barbara Reismann
Julia M. Jacobs
Jackie Adams

Private Groups/Others (cont.)

Keith Davison
Ellen Giargiari
Claudia Lefter (etal)
Claudia Lefter (for Holdens)
Nelson Holden
Daniel Giargiari (Burnam's Rest.)
Judith & Thomas Little
William & Mary Anne Coveney
Jane & Richard Dunphy
Joseph Harrington
Mrs. Paul Smith
William Murphy
Jennifer Speed
Bruce Johnson
Susan Stager
Ellen Gugel
Barbara Sullivan & Fran Lynch
Richard Fournier, Jr.
James Knowles
Peter Venuto
Patricia Pirozzi
James Waddell
Russell Fustino
Jane Fedorowicz & Michael Golibersuch
Anne Huff

SECTION 1.0 PROJECT OVERVIEW

Introduction

This Final EIR addresses the likely impacts associated with the construction and operation of local commuter rail stations in Millbury and Grafton and the potential impacts between Worcester and Framingham associated with the expansion of commuter rail service from the present three (3) round trips daily (Interim Service) to ten (10) round trips daily (Basic Service).

Under the provisions of the Special Procedure for this Major and Complicated Project, the MBTA is allowed certain discretion in filing multiple Final EIR's subject to concurrence by the Secretary of the Executive Office of Environmental Affairs (EOEA). In a Notice of Project Change submitted to the Secretary on October 31, 1995, permission was sought to prepare and file two further Final EIR's in lieu of one Final EIR for railroad operations and stations, covered by the Secretary's approval of a previous Notice of Project Change submitted on May 12, 1995. The two Final EIR's will cover all remaining issues noted in the Secretary's Certificates on the May 12, 1995 Notice of Project Change and on the July 1995 Final EIR covering Railroad Right-of-Way and Layover Facility. The request for permission to prepare and file two Final EIR's was prompted by the unresolved issues pertaining to the proposed stations in Westborough, Southborough, and Ashland, especially pertaining to their interaction around ridership and traffic and the need to address these three stations simultaneously with reconsideration of a possible regional station. When outstanding questions are resolved, the third Final EIR will be prepared for the stations the MBTA still plans in Westborough, Southborough, and Ashland.

In addition to this Final EIR, with Appendix material bound in and a separate Appendix - Volume I, supporting documents include the Draft EIR, with separate Appendix - Volume I and Appendix - Volume II, published and distributed in November 1994 and the Final EIR, Railroad Right-of-Way and Layover Facility published and distributed in July 1995.

1.1 Proposed Project

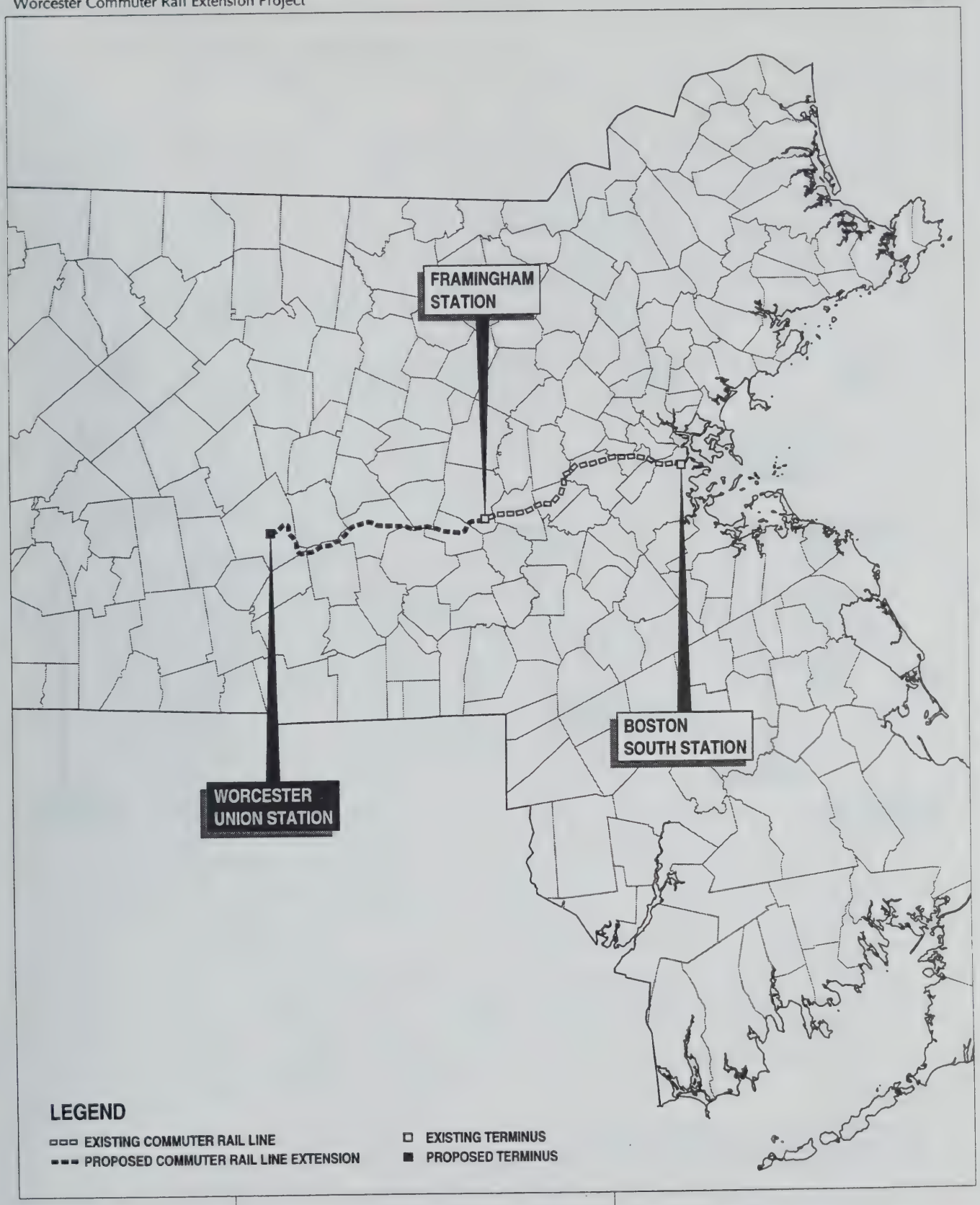
This Final Environmental Impact Report addresses the proposed extension of MBTA Commuter Rail Service on the Framingham Line from its present terminus at Framingham Station to a proposed terminus in downtown Worcester (see Figure 1.1-1).

The existing rail line between Framingham and Worcester is owned by Conrail. The proposed commuter rail service will share operations on the line with existing Conrail freight and intercity passenger service by Amtrak. The total number of train operations requires restoration of double track over the westerly 11 miles of the project between Westborough and Worcester, along with overall upgrading of track and signals to permit 60 mph speeds for the project's trains. Trackage upgrades will consist of some seven miles of new second track and four miles of upgraded second track. Conrail uses a section of the existing second track in Worcester for a storage track. To replace this capacity, a new 1.4 mile third track will be constructed along the mainline west of Union Station.

The proposed service was initiated on September 26, 1994 by operating "interim" service consisting of three peak hour trains during both the morning and evening commute, running express between Worcester and Framingham. Union Station in Worcester, currently being designed for use as an intermodal transportation facility, is expected to be re-opened in early 1998. While this site will be the ultimate commuter rail terminus, a temporary station facility was constructed at the present Amtrak station in Worcester to serve as an interim station until the Union Station project is complete.

The project proposes construction of intermediate commuter rail stations along the corridor in Millbury, Grafton, Westborough, Southborough, and Ashland (see Figure 1.1-2). The subject of this Final EIR will be the Millbury and Grafton Stations, which are anticipated to be operational by the end of 1996, plus Basic Service railroad operations. The Westborough, Southborough, and Ashland Stations, which will be the subject of a subsequent Final EIR, should be operational in 1997. Train operations will be increased to four peak hour trains in the A.M. period and five peak hour trains in the P.M. period, plus some off peak service, totaling 20 trains per day (Basic Service).

In addition to the proposed intermediate stations, a regional station was investigated to be located in the vicinity of the rail line crossing of I-495 just north of the existing I-90/I-495 interchange. In consideration of the environmental concerns, high cost of constructing access and long lead time for design and environmental permitting, a regional station is not proposed as part of this project. A Regional Station study, called



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 12 Miles

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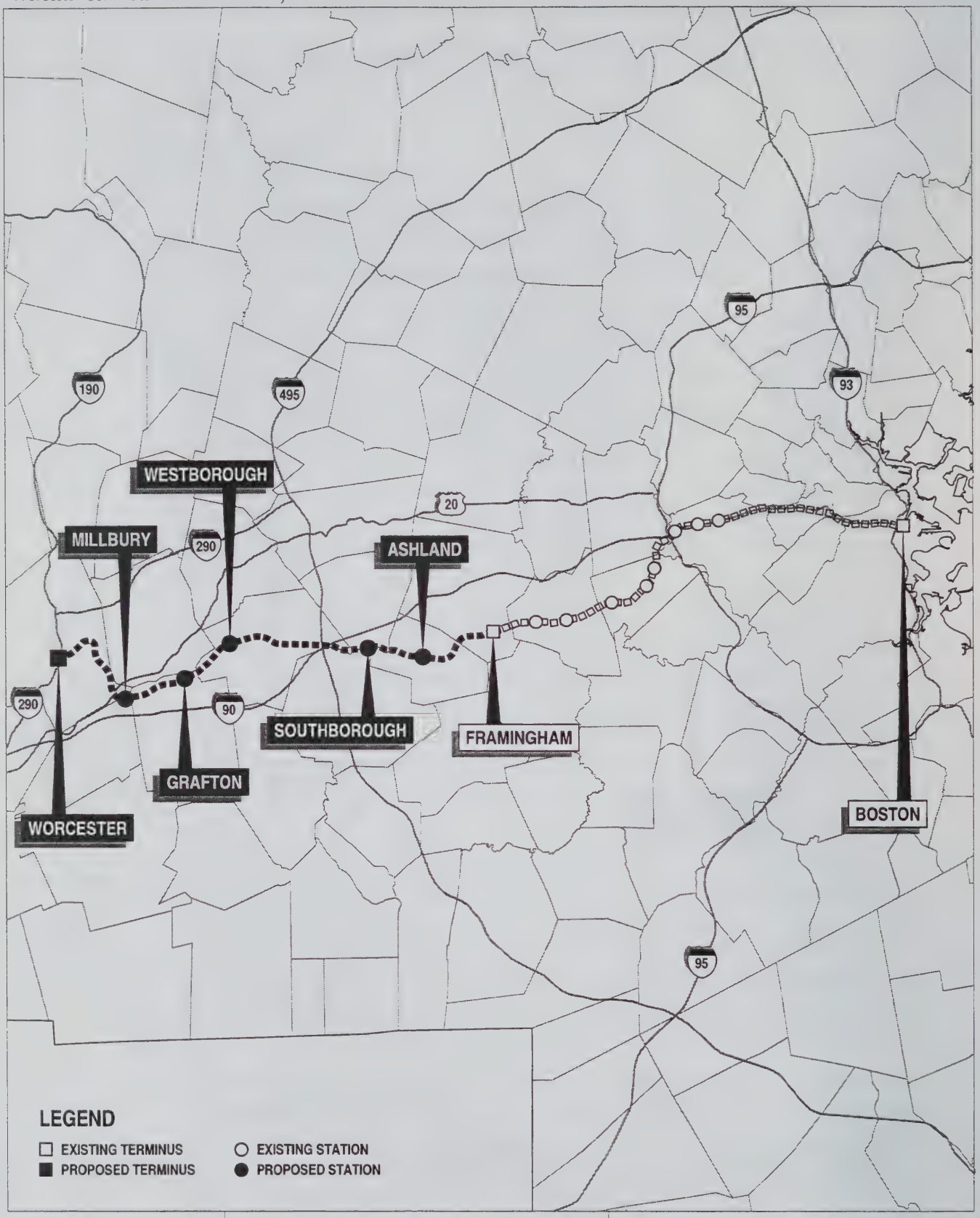
LOCUS MAP

FIGURE 1.1-1



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 6 Miles

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PROJECT CORRIDOR

FIGURE 1.1-2

for in the 1994 Transportation Bond Bill passed by the Massachusetts Legislature was completed recently. A draft of the study has been circulated to interested parties for comments. A brief summary of the Regional Station Feasibility Study results are presented in Section 3.3 of this FEIR. The formal results of that study will be reported in the Final EIR for the Westborough, Southborough, and Ashland Stations. The Notice of Project Change, which requested approval for the Two Station and Three Station Final EIR's and the Secretary's Certificate granting approval are in Appendix A of this document.

Commuter rail ridership is expected to be drawn primarily from 28 communities in the Boston Metrowest and Greater Worcester areas (see Figure 1.1-3).

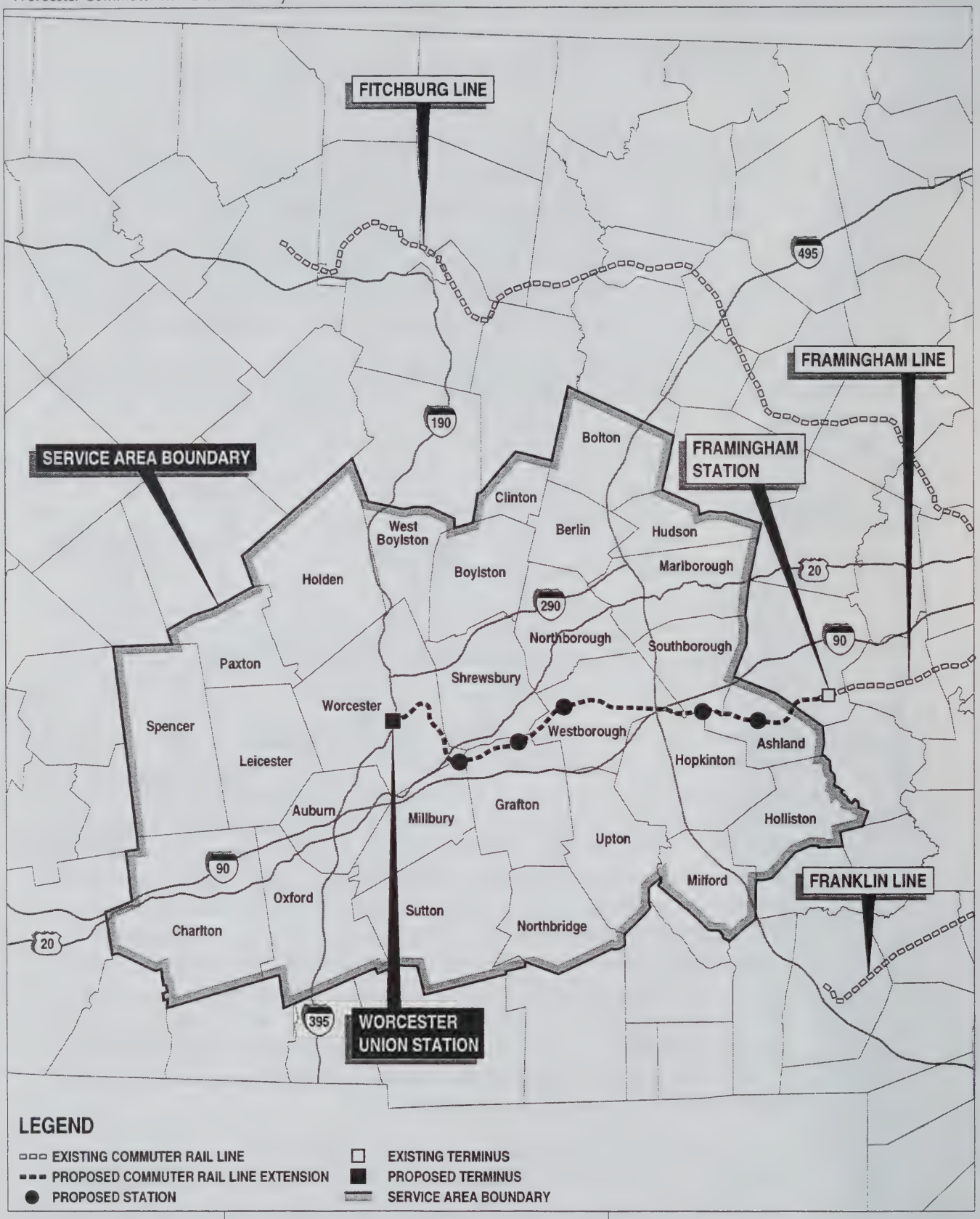
1.2 History of Project

Project Background

The Worcester Commuter Rail Extension Project has evolved and taken shape as an integral part of regional transportation and environmental initiatives. As described below, the project is one of a number of proposed public transportation projects with short and long term regional transportation and air quality benefits.

During the late 1970s and early 1980s, the Commonwealth made substantial capital investments in mass transportation corridors in the metro-Boston region, e.g., the Red Line Extensions (north and south) and the Southwest Corridor (Orange line) Project. Simultaneously, the Commonwealth was engaged in planning the Central Artery/Tunnel Project to complete the Interstate Highway system in Massachusetts and to improve the capacity and safety of existing highway facilities. The environmental review of the Central Artery/Tunnel Project undertaken between 1987 and 1991 refocused the attention of state officials on the relationship between transportation systems and air quality and the role of mass transportation in a balanced transportation system. The ensuing debate produced convincing evidence that highway infrastructure improvements, despite their beneficial effects, must be accompanied by transportation demand management and demand reduction designed to achieve successful functioning of the regional transportation system as a whole and to minimize future growth in traffic volumes seeking to use the region's necessarily limited highway capacity.

New federal air quality mandates, particularly the 1990 Federal Clean Air Act Amendments discussed below, highlighted the need to construct mass transportation improvements and to devise other transportation strategies to achieve compliance with the State Implementation Plan (SIP). The Central Artery/Tunnel Project (and other propos-



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 6 Miles

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PROJECT SERVICE AREA

FIGURE 1.1-3

ed highway improvements, such as the Route 146/Massachusetts Turnpike Interchange Project in Worcester and Millbury) served as the catalyst for discussion and formulation of a strategy to expand mass transportation capacity and to introduce new services to support existing capacity in tandem with other air quality improvement measures.

A key element of the Commonwealth's transportation and air quality strategy is the expansion and improvement of the commuter rail system. On September 27, 1990, the Secretary of the Executive Office of Transportation and Construction and the Secretary of Environmental Affairs endorsed the "Massachusetts Transportation Agenda" making improved mass transportation, including commuter rail expansion, among the Commonwealth's highest transportation priorities. Thereafter, the Executive Office of Transportation and Construction identified a range of specific mass transportation improvements and made commitments to pursue a program of mass transportation improvements and control measures to reduce low occupancy vehicles use. These commitments are reflected in the record of environmental review and approval of the Central Artery/Tunnel Project, see e.g., the Secretary of Environmental Affairs' Certificate on the Final Supplemental Environmental Impact Statement, the Federal Highway Administration's Record of Decision, and the Massachusetts Highway Department's Section 61 Finding pursuant to the Massachusetts Environmental Policy Act. Many of the proposed transportation improvements and control measures are the subject of state regulations, amendments to the State Implementation Plan (SIP), and other public approval processes which either are ongoing or completed. The Worcester Commuter Rail Extension project is a state regulatory requirement, 310 CMR 7.36 (2)(c)(2), and an enforceable provision of the SIP.

MEPA Chronology

The Environmental Notification Form (ENF) for the Worcester Commuter Rail Extension Project was submitted to the Secretary of Environmental Affairs on August 17, 1992 and was noticed in the Environmental Monitor dated August 24, 1992.

Following the comment period, the Secretary on October 8, 1992, issued a Certificate establishing a Special Procedure for a Major and Complicated Project. This certificate established a Citizens Advisory Committee (CAC) to assist the Secretary in the review and evaluation of the environmental impacts of the project. The certificate on the ENF was issued on October 22, 1992, defining the scope of issues to be addressed in the Environmental Impact Report (EIR) required on the project.

A Draft EIR was filed for the overall project and was noticed in the *Environmental Monitor* of August 8, 1993. Many thoughtful comments were received on the DEIR concerning a wide range of environmental and financial issues. Given the need for

significant additional information identified in the comments, the MBTA determined that it was appropriate to withdraw the DEIR in order to address the comments in a substantially revised document.

Concurrent with the request that the DEIR be withdrawn, the MBTA filed a Notice of Project Change on November 29, 1993, that proposed an interim commuter rail service to Worcester. After careful evaluation of the proposed interim service and its potential impacts, and taking into account the comments received on the Notice of Project Change, the Secretary issued an opinion dated January 14, 1994, that the implementation of interim service would have limited environmental impact and could proceed without further review under MEPA.

The "new" Draft Environmental Impact Report was filed with MEPA and noticed in the *Environmental Monitor* on December 7, 1994. Following an extended comment period, the Secretary of Environmental Affairs issued a Certificate finding the Draft Environmental Impact Report to be adequate on March 16, 1995.

Under the Special Procedure established by the Secretary for environmental review of this project, the MBTA proposed to prepare and submit separate and sequential Final EIR's - firstly, for track improvements and layover facility, and secondly, for construction of the intermediate commuter rail stations and implementation of rail service to those stations. A Notice of Project Change outlining this proposed processing of environmental review was submitted to MEPA on May 12, 1995, and subsequently noticed in the *Environmental Monitor* on May 23, 1995. A Certificate on the Notice of Project Change was issued on June 22, 1995, in which the Secretary concurred with this proposal.

Due to the unresolved issues pertaining to the proposed Westborough, Southborough, and Ashland Stations, especially pertaining to their interaction around ridership and traffic and the need to address these three stations simultaneously, another Notice of Project Change requested that the proposed Final EIR for stations and railroad operations be prepared as two separate documents—one Final EIR for the Millbury and Grafton Stations and Railroad Operations, and a subsequent Final EIR for Westborough, Southborough, and Ashland Stations. The Notice of Project Change was filed with MEPA on October 31, 1995, noticed in the Environmental Monitor on November 7, 1995 and approved by the Secretary's Certificate dated January 10, 1996. A separate certificate on the same date, in response to a Notice of Project Change filed for the Framingham Terminal Development (EOEA No. 10106), and published in the *Environmental Monitor* on December 8, 1995, transfers the traffic and parking elements of the Framingham Station improvements to the Worcester Commuter Rail Extension environmental process.

Copies of MEPA documents relevant to this Final EIR are located in Appendix A of this volume.

Coordination with Affected Communities

The MBTA's public participation process for the Worcester Commuter Rail Extension Project began in January 1992 as part of the schematic design phase. During January, February and March of 1992, the MBTA and its consultant met frequently with towns along the project corridor. Questions and concerns about the sites that were recommended in the 1990 Feasibility Study were identified and discussed. Three intermediate sites between Framingham and Worcester (Howe Street in Ashland, Fruit Street in Westborough and Pine Street in Grafton) had been were identified in the Feasibility Study. The Fruit Street site in Westborough and the Howe Street station site in Ashland were not popular sites with nearby residents and generated much discussion during these early public coordination meetings.

At the outset of the schematic design phase, it became clear that some of the stations identified in the Feasibility Study would not survive the more detailed engineering evaluation and public review that is undertaken during the schematic design phase. Issues of adequate access, land availability, and track geometry were among the obstacles that were identified during this early period of public participation. Therefore, the first element of the schematic design phase became the re-evaluation of potential station sites along the entire rail corridor.

During the station site identification process, most of the communities along the rail corridor between Framingham and Worcester established special citizen committees to study the issue of siting a station in their town. The initial public participation process focused on meeting with these committees or Boards of Selectmen of the towns along the corridor to explain the site selection criteria and re-assessment of the station sites identified in the Feasibility Study.

The Westborough Advisory Committee was appointed in August of 1991 by the Westborough Selectmen in anticipation of the MBTA extension project.

The Westborough Advisory Committee met several times before the MBTA started the schematic design phase in January 1992. The committee meetings were videotaped and broadcast on the local public access cable TV channel. Many of the meetings also were reported by the local newspaper. The committee initiated its own station site selection process and investigated several sites in Westborough. The committee expressed a preference for the Smith Valve Parkway site. Even so, recently the Advisory Committee and the Board of Selectmen have expressed concern about the local station location (the

Board recently voted that a local station is unacceptable) and stressed the need for further study of a regional station.

The Ashland MBTA Rail Committee was appointed by the Ashland Selectmen on March 16,1992. The committee prepared a report for the Selectmen titled *"Should There be a Commuter Rail Station in Ashland?"*. The report evaluated nine potential sites and recommended a site on Pleasant Street.

The Millbury Committee was appointed by the Millbury Board of Selectmen on September 8, 1992.

The Southborough MBTA Study Committee was appointed by the Southborough Board of Selectmen in April 1992.

The Town of Grafton participated in this coordination process through its Board of Selectmen.

The City of Worcester coordinated with the MBTA through the Worcester Area Chamber of Commerce and the Mayor's Office of Planning and Community Development. The MBTA will continue coordination of commuter rail issues with the Worcester Redevelopment Authority and Worcester Regional Transit Authority, co-proponents of the Union Station restoration project which is undergoing a separate MEPA process.

Citizens Advisory Committee

Under the Certificate of the Secretary of Environmental Affairs Establishing a Special Procedure for a Major and Complicated Project, a Citizens Advisory Committee (CAC) was formed to assist the Secretary in review and evaluation of the environmental impacts of the project.

Members of the CAC included one representative from each of the local communities, plus two or more additional representatives from each community and included some elected or appointed officials, members of town rail committees, and representatives of transportation and planning organizations. In January 1993, the Secretary accepted a 28 member committee. On July 10, 1995, the Secretary called for a redesignation and expansion of the CAC to include representation by Hopkinton and Framingham.

During the course of the environmental studies, the MBTA and its consultants met with the CAC, as frequently as once a month, to discuss the project's progress and to allow the CAC to review preliminary environmental documents. These meetings usually were broadcast on the local public access cable TV channel and reported in various newspapers. The CAC also has visited each of the proposed station sites and the Worcester Layover Facility on field trips sponsored by the MBTA.

Under the provisions of the Special Procedure, Sections of this Final EIR will be submitted to the CAC prior to submission to MEPA for notice in the *Environmental Monitor.*

1.3 Permits and Approvals

The MBTA has initiated project planning and conceptual design consistent with the requirements of the following environmental permits and approvals likely to be needed. Coordination among the MBTA, federal, state, and local agencies, the CAC, and interested groups and individuals, will continue during review of the Final EIR's, and thereafter through final design, permitting, and construction.

Notice of Construction (EPA)

The project, or some of its elements, may require a notice of construction commencement to Region I of the United States Environmental Protection Agency.

Notice of Construction (DEP)

The project, or some of its elements, may require a notice of construction commencement to the Massachusetts Department of Environmental Protection.

Conformity Analysis (Boston MPO)

The project is included in the Clean Air Act conformity analysis for eastern Massachusetts performed by the Executive Office for Transportation and Construction and reported on in the *Boston MPO TIP (FY1995-FY1997, Revised), March 27, 1995,* §2.4, Ch. 10, Appendix A. No project-level conformity analysis is required.

Section 404 Permit, Federal Clean Water Act

The project would require a section 404 permit for any fill contemplated in federally delineated wetlands. Since it is anticipated that the wetlands fill activities associated with the project will affect less than one acre, the project likely will have the benefit of the programmatic general permit administered by the U.S. Army Corps of Engineers. Based on analysis to date, it appears that the project may qualify as a non-reporting Category I activity under the programmatic general permit. In the event that the project does not meet the Category I thresholds, the MBTA would file an application with the Corps pursuant to Category II.

Section 401 (Water Quality Certification) Permit, Federal Clean Water Act

This permit is triggered by any permit required under the Federal Clean Water Act, e.g., the section 404 permit described above. DEP has the authority to issue water quality certification subject to the Massachusetts Water Quality Standards. DEP currently is in the process of consolidating its wetland protection programs in proposed regulations on water quality certification. Under the proposed regulations, federal and state wetlands will be considered cumulatively. As currently proposed, the project will fill less than 5,000 sf. of bordering vegetated wetland, a key threshold for purposes of water quality certification.

Section 402 (National Pollution Discharge Elimination System) Permit, Federal Clean Water Act

Under Section 402(p) of the Federal Clean Water Act, stormwater discharges "associated with industrial activity," including construction activity disturbing more than five acres, must be authorized by an NPDES permit. EPA also is authorized to require NPDES permits for stormwater discharges from non-industrial activities, so-called "Phase II" discharges. It appears that the project is eligible for the general NPDES permit for construction. Unless a project related storm water discharge will contribute to a violation of a water quality standard or be a significant contributor of pollutants to waters of the United States, an individual permit likely would not be required. The MBTA will prepare storm water pollution prevention plans in accordance with the general permit requirements, including appropriate setbacks and other best management practices under the Massachusetts section 401 stormwater discharge certification for the general permit.

Orders of Conditions, Massachusetts Wetlands Protection Act

Any non-exempt activity that will alter a wetland resource area or be conducted in the 100-foot buffer zone have been presented to the local conservation commissions through filing of Notices of Intent for review. Based on current design development, the rail corridor improvements will alter approximately 180 sf of bordering vegetated wetlands. Notices of Intent for stations, in particular in Millbury and Grafton, are in process.

SECTION 2.0 PREFERRED ALTERNATIVE AND FINANCIAL FEASIBILITY

Introduction

This section of the FEIR seeks to lay out the genesis of the preferred alternative identified and to detail the fiscal capacity of the MBTA, and the Commonwealth generally, to pay for that alternative. Section 2.1 reviews the alternatives considered in the 1990 feasibility analysis which led to the choice in principle of the Worcester Rail alternative. The evolution, following the completion of the feasibility study, of the Worcester Rail choice into the preferred alternative portrayed and analyzed in the DEIR also is detailed, as is the meaning, for the DEIR and this FEIR, of the No Build option against which project impacts are to be assessed, since it is not a No Build as customarily understood. Section 2.2 reviews a range of materials already in the public domain to assess the MBTA's general fiscal health and particular capacity to undertake the Worcester Rail project. Section 2.3 argues that, since this capacity can be established clearly and because the project is a state and Federal regulatory requirement, no further financial analyses are needed.

2.1 Alternatives Considered

The MBTA reviews in this section several alternatives to the project presented in the DEIR and this FEIR. First, alternatives are reviewed which were considered in the MBTA's 1990 feasibility report, where the initial choice of the Worcester Extension project is explained. Revisions to the Worcester option since the 1990 feasibility report then are considered and cost estimates brought current. The DEIR commuter bus alternative to the Worcester Extension project and the DEIR No Build alternative are reviewed.

Feasibility Report Analyses

To advance its policy of revitalizing commuter rail services in the Boston metropolitan area, the legislature authorized the MBTA to perform a feasibility study of restoring service to Worcester. Added later to this study for consideration were alternatives of

possible extensions of service from Framingham to Milford, via the existing 12.3 mile Holliston Industrial Line, and from Framingham to Marlborough, via a 10.3 mile right-of-way comprising the Framingham Secondary and Fitchburg Secondary lines. Milford service had been discontinued in 1959, Marlborough service in phases in the 1930's. Freight service along some of these lines continued, though in some areas only infrequently, while in other areas tracks have been removed altogether.

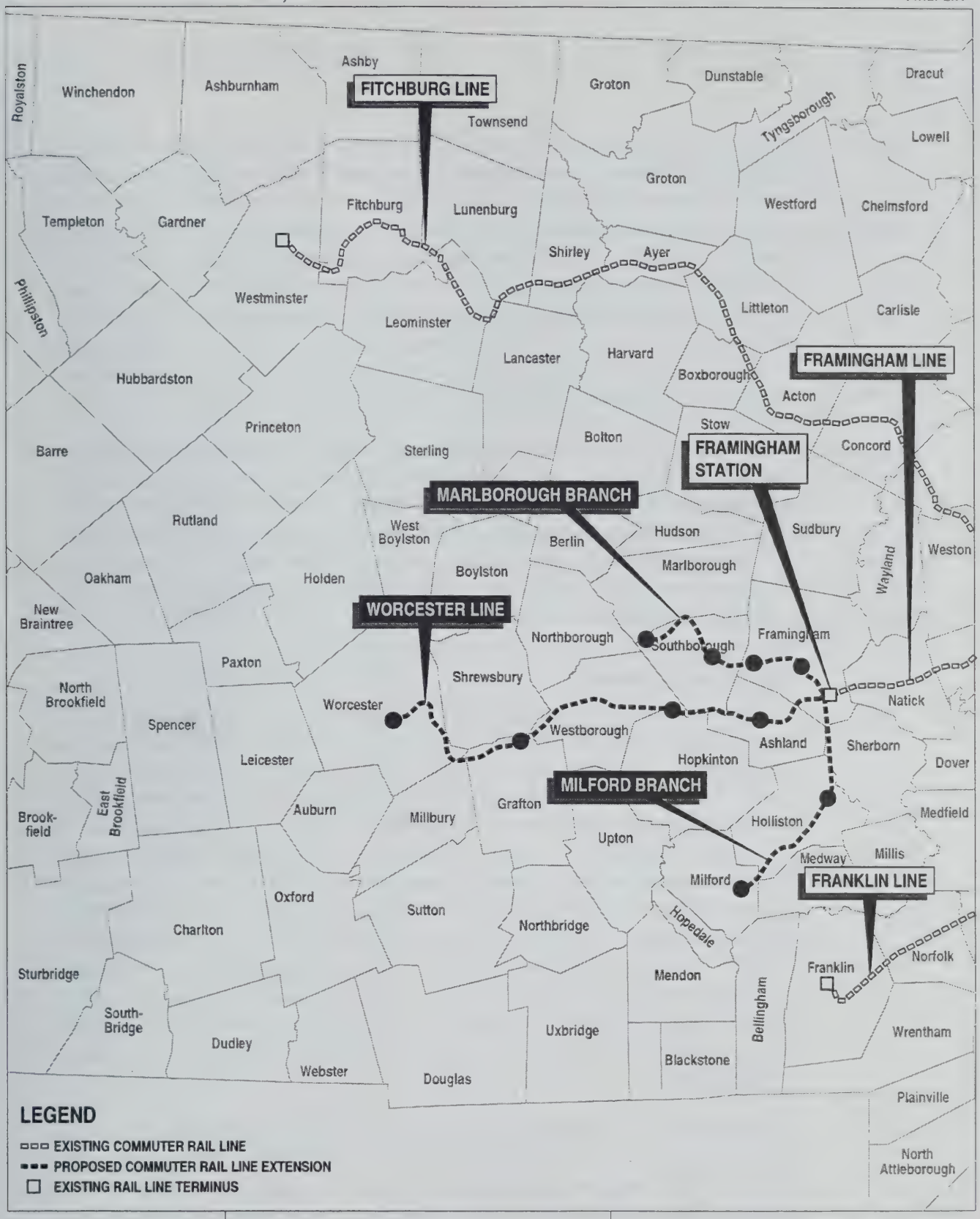
Alternatives Considered

The three lines evaluated in the feasibility study were compared using uniform assumptions: upgrading of track, signals, sidings, grade crossings, and right-of-way fencing to meet MBTA standards; upgrading or creation of stations with standard platforms, canopies, handicapped access by means of so-called "mini-high" platforms; parking to serve projected ridership; 30 minute headways in the peak, 120 minute headways otherwise, to meet MBTA standard operating schedules; modern diesel locomotives and bi-level coaches for rolling stock, of a quantity to meet scheduling and projected passenger volume needs; and layover facilities adequate for four train sets per line.

Several locations on each line were screened for possible stations, using such criteria as parking area adequacy (minimum 250 spaces at grade), need for site grading, wetlands proximity, access to major arterial highways, residential impacts, development costs (including relocation costs), parcel assembly difficulties and station spacing. A preferred location was developed for each proposed station area. The Worcester service assumed new intermediate stations at North Grafton, Westborough and Ashland, the Marlborough service new intermediate stations at North Framingham, West Framingham, Southborough Center and Southborough/495, and the Milford service new intermediate stations at East Holliston and Holliston. See Figure 2.1-1.

The Feasibility Study assembled these services into four rail/bus alternatives and a bus-only alternative.

Rail Alternative #1 was new Worcester/Boston commuter rail service, with Marlborough/Boston express bus service during the commuter peaks, and semi-express service during the commuter peaks for Worcester, Shrewsbury, and Westborough. No expansion was assumed in existing private Worcester express bus service. Rail Alternative #2 was Rail Alternative #1 plus peak hour Milford/Boston commuter rail service only, with shuttle bus service along the Milford route between Framingham and Milford in off-peak times. Existing private bus service for Milford was assumed to end at Medway because of the diversion of Milford patrons to the improved and extended Franklin rail line. Rail Alternative #3 was Marlborough service plus Milford service. Trains would



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 6 Miles

0 6

FEASIBILITY STUDY
ALTERNATIVE LINES / STATIONS

FIGURE 2.1-1

make all stops to Framingham; then, for a given departure interval, the train from or to Milford would proceed as an express, and the train from or to Marlborough as a local, or *vice versa*. Existing Milford buses would run only to Medway, as above; the Marlborough/Southborough/Boston route would be dropped. Existing Peter Pan service along Route 9 and the Massachusetts Turnpike was assumed to operate as at present. Rail Alternative #4 was new Marlborough service only. This would be local service beyond Framingham at all times, but express service between Boston and Framingham for peak commuting times. The Marlborough/Southborough/Boston bus route would be dropped. Existing Peter Pan service along Route 9 and the Massachusetts Turnpike was assumed to operate as at the time of the study.

The Bus Alternative assumed no expanded commuter rail service, and enhancements of existing bus service for Worcester/Shrewsbury/Westborough, for Marlborough/Hudson/Southborough, and for Milford. These enhancements concentrated on upgrading peak hour service to 30 minute headways at a minimum, with auxiliary park-and-ride lots to concentrate patrons and reduce stopping time. Since Milford service is assumed because the Franklin commuter rail line is part of the No Build condition, expanded bus service would end at Medway.

Service Areas and Ridership

The service area boundaries for all three rail lines under consideration were, roughly, Spencer on the west, Framingham on the east, the Fitchburg MBTA commuter line communities to the north, and the Franklin MBTA commuter line communities to the south--31 communities in all. The chief focus of the feasibility study's ridership estimates was commuting to Boston from these communities, projected to comprise--based on experience at other MBTA commuter rail lines--about 90% of total ridership and about 95% of peak hour ridership. Estimates of these commutes for 1987 and 2010 were based on information developed by the Boston Metropolitan Planning Organization (MPO) for the Commonwealth's Central Transportation Planning Staff (CTPS) on commutes to Boston from eastern Massachusetts as well as from communities in New Hampshire, Maine, Rhode Island and Connecticut. Some of this information came from the journey-to-work surveys of the 1980 U.S. census, some from analyses for the Central Artery/Third Harbor Tunnel project, and some from other socioeconomic data concerning the relevant cities and towns.

The feasibility study estimated work trips to downtown Boston from the 31 projected service area communities to be 7,060 in 1987, and 10,130 in 2010, about a 43% increase. The corresponding population for 1987 was 553,160, and for 2010 an estimated 582,340--a 5.2% increase. See Table 2.1-1. For the Worcester line's projected 19 service area communities, there were an estimated 2,800 trips to Boston in 1987, and

4,130 trips were projected for 2010, a 47.5% increase. For the Marlborough line's 9 projected service area communities, there were estimated 4,670 trips to Boston in 1987, and 6,640 trips were projected for 2010, a 42% increase. For the Milford line's 4 projected service area communities, there were an estimated 650 trips to Boston in 1987, and 930 trips were projected for 2010, a 43% increase. (The overall trips-to-Boston figures are slightly lower than the sum of separate estimates for the three services being considered because that sum double-counts potential riders from those communities which more than one line could service.)

Using these estimates of total trips to downtown Boston from the service area, the feasibility study proceeded to estimate how many of them might use each of the rail line or bus alternatives under consideration, assuming certain transportation networks and mode choice factors. For 1987, the Worcester area highway network was added to the CTPS model for metropolitan Boston, and necessary empirical data on traffic flows for the highway links added. The 2010 network used the 1987 baseline and assumed as well completion of the Central Artery/Third Harbor Tunnel, extension of the Franklin commuter rail line to Milford, and, depending on the alternative analyzed, peak hour express bus to Worcester and Marlborough. Mode choice factors, which are assembled in a model which projects trips by mode, address factors such as travel time, travel distance, and travel cost.

Table 2.1-1 Worcester Commuter Rail Extension Study Area

City/Town	Est. 1987 Population	Est. 2010 Population	Est. 1987 Work Trips to Downtown	Est. 2010 Work Trips to Downtown
Framingham	63,800	65,100	2,640	3,710
Sudbury	14,120	14,000	700	960
Ashland	11,200	14,000	170	290
Holliston	12,950	14,000	300	440
Medway	9,500	10,810	210	330
Mendon	3,530	4,150	30	40
Hopedale	3,980	4,060	20	30
Milford	24,280	24,480	320	450
Hopkinton	8,700	9,400	210	310
Southborough	6,430	7,700	210	350
Marlborough	31,150	35,250	360	570
Hudson	17,700	18,250	100	150
Berlin	2,230	2,250	40	50
Northborough	11,340	11,620	120	170
Westborough	13,100	13,600	290	370
Upton	4,300	4,910	30	40
Northbridge	12,450	12,750	20	30
Grafton	11,900	13,620	30	50
Shrewsbury	22,590	23,120	160	250
Boylston	3,540	3,630	20	30
W. Boylston	6,030	5,660	10	10
Worcester	166,000	170,000	780	1,030
Millbury	11,820	11,460	30	40
Sutton	6,600	8,360	30	50
Oxford	12,370	12,960	50	80
Auburn	14,400	14,400	30	80
Leicester	9,650	10,090	40	60
Paxton	3,830	3,820	20	20
Holden	13,770	14,090	20	30
Spencer	11,600	12,480	50	80
Charlton	8,300	12,320	20	30
TOTAL	**553,160**	**582,340**	**7,060**	**10,130**

The results are shown on Table 2.1-2, which reflects both work and non-work trips for 2010. Rail Alternative #3, Marlborough and Milford service, is projected to attract the largest number of passengers overall, 3,860. Rail Alternative #2, Worcester and Milford service, attracts the largest number of commuter rail passengers, with Rail Alternative #3 close behind. The Bus Alternative never attracts as many riders as any rail alternative. Under Rail Alternative #1 and Rail Alternative #2, higher commuter rail speeds make for essentially negligible use of the assumed parallel bus services. Under Rail Alternative #3 and #4, bus services for Worcester service communities were estimated to attract the bulk of projected bus riders, about 950 of them each.

Table 2.1-2 Total Rail and Bus Boardings -Daily Inbound Person Trips

Station	Bus Alt.	Alt. 1 2010	Alt. 2 2010	Alt. 3 2010	Alt. 4 2010
Framingham		1,230	1,230		
Ashland		630	360		
Westborough		920	920		
North Grafton		120	120		
Worcester		880	880		
Framingham				1,320	1,620
Salem End Road				810	820
California Avenue				550	550
Main Street				180	180
Northborough Road				580	730
East Holliston			430	460	
Holliston			130	150	
Milford			180	180	
*Rail Subtotal**	*0*	*2,550*	*3,020*	*2,910*	*2,280*
Bus Subtotal	*1,530*	*40*	*40*	*950*	*950*
TOTAL*	**1,530**	**2,590**	**3,060**	**3,860**	**3,230**

* Framingham Station excluded

Costs and Revenues

The feasibility study compared the rail alternatives and the bus alternative on the basis of their projected costs, capital and operating, and projected revenues. Each of these projections is based on complex assumptions reviewed in detail in the feasibility study.

Capital costs are for required rolling stock to meet projected schedules, but corrected for the melding of existing Framingham service with proposed new alternatives; stations, including site acquisition, relocation costs where applicable, and construction; and right-of-way improvements. Table 2.1-3 details the feasibility study's estimated capital costs in 1989 dollars. To these costs have been added a 20% contingency and 15% for engineering, applied to right-of-way and station costs only. Rail Alternative #1 is the cheapest; Rail Alternatives #2 and #3 are closely comparable and the most expensive; and Rail Alternative #4 is in the middle.

Annual operating and maintenance (O&M) costs are also net, corrected for Framingham costs made redundant by the various new services. See Table 2.1-4. Plainly, in significant part, annual O&M costs for the various alternatives are dependent on needed rolling stock. Simply on the numbers, new service to only one destination is, not surprisingly, cheaper than combined services. Overall, Rail Alternative #4, Marlborough service only, is the cheapest, at $4.33 million per year, and Rail Alternative #1, Worcester service only, is next cheapest, at $5.08 million per year. The combined services are significantly more expensive--Rail Alternative #3, Marlborough/Milford, is $6.29 million, and Rail Alternative #2, Worcester/Milford ,is $7.07 million.

Annual net O&M costs are the basis for two further feasibility study calculations for the rail alternatives, cost per passenger and cost per revenue train mile. See also Table 2.1-4. Cost per passenger is the quotient of annual O&M costs divided by net annual passengers inbound and outbound. Annual O&M costs net out costs of Framingham service--peak and off-peak for Rail Alternatives #2 and #3, off-peak only for Rail Alternatives #1 and #4--made redundant by the proposed new service. Cost per revenue train mile, which also nets out certain Framingham costs, is the quotient of annual net O&M divided by net revenue train miles. A revenue train mile is a mile for which revenue is collected. Here the Worcester commuter service, Rail Alternative #1, is plainly superior; the other single-destination service, Marlborough-only, Rail Alternative #4, is the most expensive, with the combined services of Rail Alternative #2 and Rail Alternative #3 in the middle, though not particularly close.

Table 2.1-3 Summary of Capital Costs (1989 $Thousands)

Category	Alternative No. 1 Worcester City	Alternative No. 2 Worcester/ Milford	Alternative No. 3 Marlborough/ Milford	Alternative No. 4 Marlborough Only
Right of Way Improvements (includes bridges & culverts)	10,909.0	25,970.0	27,786.0	12,968.0
Stations	20,200.1	23,847.2	21,346.5	18,943.8
Rolling Stock ($1.34M trailer, $1.47M control car, $2.3M engine)	34,680.0	38,700.0	39,790.0	41,380.0
Subtotal	65,789.1	88,517.2	88,922.5	73,291.8
Contingency (@20%)	6,221.8	9,963.4	9,826.5	6,382.4
Engineering (@15%)	4,666.4	7,472.6	7,369.9	4,786.8
TOTAL	**76,677.3**	**105,953.2**	**106,118.9**	**84,460.9**

Table 2.1-4 Rail Operating and Maintenance Costs

Measure	Alt. 1 Worcester Express	Alt. 2 Worcester Milford	Alt. 3 Marlborough Milford	Alt. 4 Marlborough Express
Annual O&M Cost Estimate				
Annual O&M Cost of New Service (in million$)	$6.33	$11.54	$10.76	$5.58
Annual O&M Cost of Framingham Service (in million $)	$1.25	$4.47	$4.47	$1.25
Annual O&M Cost of Extension (in million $)	$5.08	$7.07	$6.29	$4.33
Unit Costs of Service				
Cost Per Passenger	$4.33	$4.98	$4.46	$3.50
Cost/Rev. Train Mile	$22.86	$27.17	$32.60	$35.82

Besides the rail alternatives, costs for the Bus Alternative and the express bus services associated with the four rail alternatives also were developed in the Feasibility Study. Local services were, for costing purposes, deemed not integral to the analysis, and, in any

case, likely to be marginal. The Bus Alternative costs appear in Table 2.1-5. Cost per passenger is $1.96, and per revenue bus mile $2.22. Because the ridership forecasting model assigned no trips to the Worcester express bus service under Rail Alternative #1 and #2, no costs were calculated for this service, but for Rail Alternative #3 and #4, the cost per passenger is $2.23, and cost per revenue bus mile $2.06.

Table 2.1-5 Bus Operating and Maintenance Costs

Measure	Bus Alternative	Alternatives 3 and 4 Worcester Express
Revenue Bus Miles	691,637	518,636
Annual IB Passengers	391,870	239,330
Annual Passengers (IB + OB)	783,740	478,660
Annual Bus O&M Cost (millions)	$1.53	$1.07
Cost Per Passenger	$1.96	$2.23
Cost/Rev. Bus Mi.	$2.22	$2.06
Pass./Rev. Bus Mi.	1.13	0.92

Cost Effectiveness

Overall cost comparisons were then developed for the four rail alternatives and the Bus Alternative. In terms of total annual net O&M cost, the Bus Alternative is the cheapest overall, but Alternative #1 is the cheapest among the rail alternatives. See Table 2.1-6. In terms of cost per passenger comparisons, the Bus Alternative is the cheapest per passenger, but serves, by far, the fewest passengers, as Table 2.1-2 shows. Rail Alternative #4 has the lowest cost per passenger, Rail Alternative #1 the second highest cost. It needs to be kept in mind that these are out-of-pocket costs, but not necessarily MBTA costs, that are being analyzed. The MBTA would pay for commuter rail costs, but not for much of the express bus costs, since these are offered, for the most part, by private sector companies.

Table 2.1-6 Total Operating and Maintenance Costs

Measure	Bus Alternative	Alt. 1 Worcester Express	Alt. 2 Worcester Milford	Alt. 3 Marlborough Milford	Alt. 4 Marlborough Express
Passengers		1,172,980	1,420,200	1,409,680	1,236,100
Annual Rail Passengers (IB+OB)					
Annual Bus Passengers (IB + OB)	783,740			478,660	478,660
Total Passengers	783,740	1,172,980	1,420,200	1,888,340	1,714,760
O&M Costs					
Net Rail O&M Cost (in million $)	$0.00	$5.08	$7.07	$6.29	$4.33
Bus O&M Cost (in million $)	$1.53	$0.00	$0.00	$1.07	$1.07
Total O&M Cost	$1.53	$5.08	$7.07	$7.36	$5.40
Unit Costs					
Cost Per Passenger	$1.96	$4.33	$4.98	$3.90	$3.15

The cost analysis can be brought full circle by determining the net annual costs of the various alternatives considered in the feasibility study. Net annual cost is the sum of net annual operating costs and annualized capital costs. Any capital cost can be annualized by dividing its separately costed elements by their respective life expectancies in years, and then summing the resulting quotients, though this plainly does not consider interest costs and inflation. The feasibility study estimates life expectancies for various project components as they are used in the various rail alternatives. In the feasibility study, Rail Alternative #1, Worcester commuter service, has the lowest net annual cost among the rail alternatives. See Table 2.1-7. The Bus Alternative has a considerably lower annual cost, $2.2 million, but the feasibility study did not provide revenue estimates for this option, so net annual cost cannot be calculated.

Table 2.1-7 Net Annual Cost of Rail Alternatives ($ Millions)

	Alternative #1	Alternative #2	Alternative #3	Alternative #4
Annualized Capital Cost	8.32	11.53	11.84	9.30
Annual Operating Cost	5.08	7.07	7.36*	5.40*
Total Annual Cost	13.40	18.60	19.20	14.70
Annual Revenues	3.82	4.94	2.62	1.70
Net Annual Cost	9.58	13.66	16.58	13.00

** Includes Both Rail and Bus*

The ultimately favorable cost/benefit performance of Rail Alternative #1, among the rail alternatives considered in the feasibility study, is based on its particularly good estimated revenues, as shown in Table 2.1-7. Because the Worcester commuter service extends farther from Boston, it involves more zones with progressively higher associated fares per zone than the relatively short services to Marlborough or to Milford. The longer runs lead to higher revenues.

Preferred Alternative Changes Since Feasibility Analysis

The feasibility report cost estimates do not reflect all the costs of the project now under MEPA review, as the project has been somewhat redefined since the feasibility report. Two additional stations have been added, in Millbury and Southborough. These new stations will require additional signals and other infrastructure. Parking has been expanded beyond what the feasibility report covered. As currently proposed, the MBTA now estimates the project will cost $114 million, of which about $80 million will be for track and signal improvements, layover facility, stations, land acquisition costs and mitigation, and $34 million for rolling stock. Table 2.1-8 provides a breakdown of the estimated project costs. The MBTA plans to use state bond funds to cover the project's capital costs. Annual debt service will equal approximately $9.7 million, according to the MBTA's most recent estimate.

The MBTA's most recent estimate of operating costs per year for the Worcester extension as now proposed is approximately $12 million. Annual revenue is projected at approximately $5 million. This yields about a 42% cost recovery ratio for the proposed Worcester service. This ratio is well in excess of the MBTA's overall target of 33-1/3% for recovery of all operating costs, and higher than for other commuter rail services offered by the MBTA.

Table 2.1-8 Estimated Project Cost

Project Element	Estimated Cost	Project Element	Estimated Cost
Track and ROW Improvements		**Layover Facility**	
Trackbed Preparation	$4,500,000	Track and Fencing	$2,000,000
ROW Fencing	$300,000	Electrical System	$1,800,000
Bridge, Wall, Repairs	$1,850,000	Lighting	$250,000
Noise and Vibration Mitigation	$1,200,000	Drainage and Grading	$200,000
Conrail Force Account Work		Crew Quarters and Parking	$800,000
New Interlockings (CP 22 to Worcester)	$7,740,000		
Second Track MP 33-40	$12,575,000	**Station/Parking Development**	
Cab Signals ("Cove" to CP 22)	$2,300,000	Ashland	$4,610,000
New Storage Track	$1,800,000	Southborough	$3,220,000
New Crossover CP 45	$763,000	Westborough	$2,819,000
Retire CP 44	$707,000	Grafton	$3,045,000
Flagging	$755,650	Millbury	$3,306,000
		Worcester	$1,500,000
		Land Acquisition	
		(station sites and layover)	$7,000,000
Subtotal	**$34,490,650**	**Subtotal**	**$30,550,000**
	Total Rail and Site		**65,040,650**
	3% Project Administration and Field Inspection		1,951,220
	12% Contingency		7,804,878
	8% Engineering Design		5,203,252
	TOTAL CONSTRUCTION ESTIMATE		**80,000,000**
	Rolling Stock: (4 train sets)		34,000,000
	TOTAL PROJECT COST		**$114,000,000**

Table 2.1-9 Annualized Capital Cost for Preferred Alternative

Capital Element	Years' Life Expectancy	Cost	Annual Cost
Land	100	$6,000,000	$60,000
Roadbed	100	$3,500,000	$35,000
Tracks	30	$14,300,000	$476,366
Bridges	30	$1,700,000	$56,667
Signals	30	$14,391,000	$479,700
Stations	30	$19,800,000	$660,000
Layover	30	$5,050,000	$168,333
Fencing	20	$300,000	$15,000
Rolling stock	25	$34,000,000	$1,360,000
TOTALS		**$99,041,000**	**$3,311,066**

The MBTA has calculated the net annual cost of the project, which is the sum of its annualized capital cost and its estimated annual operating cost, less estimated revenue. The annualized capital cost of the project is $3.3 million. See Table 2.1-9. Since, as just stated, the MBTA projects an annual operating cost for the project of $12 million, the project's total annual cost is $15.3 million. Less projected annual revenue of $5 million, the project's net annual cost is approximately $10.3 million. See Table 2.1-10.

The annual net cost recalculation for Worcester Rail in Table 2.1-10 suggests also the need to recalculate the annualized capital cost figures given for the four rail alternatives in the feasibility study, using raw data from the feasibility study. The results still favor Rail Alternative #1 among the rail alternatives. See Table 2.1-11. Although it is not possible, using the feasibility study, to assess the net annual cost of the Bus Alternative, this recalculation of annual net cost for the rail alternatives certainly reduces the cost disparity between rail and bus options for enhanced Worcester commuter service. Of course, it does not eliminate the volume of service disparity, which remains very large.

Table 2.1-10 Net Annual Cost of Worcester Extension Project

Annualized Capital Cost	$3,311,066
Annual Operating Cost	$12,000,000
Total Annual Cost	$15,311,066
Annual Revenues	5,000,000
Net Annual Cost	$10,311,066

Table 2.1-11 Recalculated Annual Net Cost of Rail Alternatives ($ Millions)

	Alternative #1	Alternative #2	Alternative #3	Alternative #4
Annualized Capital Cost	2.27	3.00	3.02	2.55
Annual Operating Cost	5.08	7.07	6.29	4.33
Total Annual Cost	7.35	10.07	9.31	6.88
Annual Revenues	3.82	4.94	2.62	1.70
Net Annual Cost	3.53	5.13	6.69	5.18

Commuter Bus Service Alternative

The MBTA for the DEIR developed a commuter bus service alternative more comprehensive than was considered in the feasibility study. The performance standard for this alternative was to approximate, by means of peak-hour express and off-peak semi-express bus service, the commuter rail services proposed by the preferred alternative at its respective stations, so as to lay the basis for environmental analyses whose results would be strictly comparable. Under this alternative, several elements of the preferred alternative would go away, but several would remain. The elements going away would be the layover facility, all station work, and much track and signal work. The elements remaining would be all parking lots, all approaches to the parking lots, and most drainage facilities.

The MBTA estimated the net annual cost for the commuter bus service alternative in the DEIR. The estimates of Worcester Rail's capital costs in the DEIR have been used as the basis for comparing the annualized capital costs of the Worcester rail and commuter bus alternatives, using the many elements of the commuter rail project, including land acquisition, parking lot development and site drainage, which also will be part of the commuter bus service alternative. Also, the feasibility study's estimate of 12 years was used as the measure of a bus's life expectancy, since feasibility study estimates for all other life expectancies were used in estimating annualized capital costs in the DEIR. The MBTA estimates that the commuter bus option would require approximately 57 buses costing approximately $275,000 each, or $15,675,000 all told. The results are in Table 2.1-12. The annualized capital cost then is used as an element in the net annual cost estimate. The MBTA's DEIR estimate of revenues from the commuter rail project will be used for the commuter bus service alternative as well. Existing data on MBTA express buses was used to estimate O&M costs for the required commuter bus service fleet. The results are in Table 2.1-13.

Table 2.1-12 Annualized Capital Cost for Commuter Bus Alternative			
Capital Element	**Years' Life Expectancy**	**Cost**	**Annual Cost**
Land	100	$5,000,000	$50,000
Parking Facilities	30	7,700,000	256,666
Buses (57 @ $275,000)	12	15,675,000	1,306,250
TOTAL		**$28,375,000**	**$1,612,916**

Table 2.1-13 Net Annual Cost of Commuter Bus Alternative	
Annualized Capital Cost	$1,612,916
Annual Operating Cost (Busses Only)	$1,624,000
Total Annual Cost	$3,236,916
Annual Revenues	$5,000,000
Net Annual Cost	($1,763,084)

No Build

With operations so complex as those on the existing Conrail right-of-way on which the project would operate, it is important to note that some activities discussed in the DEIR are very likely to happen in any case, and should be kept in mind when thinking about the difference between No Build and Build impacts. Among the very likely things that will happen are the track lowering along the Conrail right-of-way to achieve 21'-0" vertical clearance for freight (not part of this project, by EOTC), the reconstruction of four bridges over the Conrail right-of-way, and the demolition of one bridge over the right-of-way. MHD will see to any required environmental review concerning the bridge reconstructions or demolition. Also likely to happen are construction of 1,500 Park'n'Ride parking spaces by the Massachusetts Turnpike Authority at various Turnpike exits, upgrade of approximately 4 miles of Route 146 in Worcester County from 2 lanes to 4 lanes, a new Massachusetts Turnpike/Route 146/Route 20 interchange. Among the things that may well happen in any case are the reconstruction of missing track, and upgrading of other track, in the Conrail right-of-way.

2.2 Financial Feasibility of Preferred Alternative

The DEIR identified the preferred alternative and reviewed and updated the cost estimates of the 1990 Feasibility Report. Nonetheless, a number of commentaries on the DEIR raised questions about the financial capacity of the MBTA to undertake the Worcester project. In this FEIR, the MBTA wishes to address its financial capacity to undertake the preferred alternative. Since the preferred alternative is the most expensive alternative considered, if it is within the MBTA's capacity, all other alternatives are, by definition, within the MBTA's capacity. The MBTA notes that this capacity question, at least on the capital side, is essentially moot, since the Legislature, in the 1994 transportation bond legislation, authorized for the Worcester project $78 million not transferrable to any other project. Acts of 1994, c. 273, §2H, line item 6005-9534, and §24. C. 273 also authorizes funds for rolling stock acquisition, *cf.* §2H, line item 6005-9514 ($37,000,000).

The MBTA proposes, for the financial capacity analysis of this FEIR, to build on the financial analyses of the MBTA's *Greenbush SDEIS/R* and *South Boston Piers FEIS/R,* to establish the MBTA's financial capacity to undertake the Worcester Commuter Rail preferred alternative. The MBTA documents establish that the MBTA itself has the capacity to proceed with Worcester Rail, among several other projects.

MEPA recently has reviewed a number of MBTA capital projects which were the subject of various financial analyses. The most recent such analyses were presented in the *Greenbush SDEIS/R* and the South Boston Piers FEIS/R. The *Greenbush SDEIR* was approved by the Secretary's certificate dated June 1, 1995. No further financial questions were posed for the FEIR that must still be submitted on the Greenbush line. The South Boston Piers FEIS/R was approved by the Secretary's certificate dated February 16, 1994.

Since the Secretary's Certificate on the *Greenbush SDEIR/S* required no further financial analysis in the Greenbush MEPA review, the MBTA views the Greenbush financial analysis as an appropriate resource for discussing the MBTA's overall capacity to support the Worcester preferred alternative. This analysis includes the capital and operating expenses of Worcester Rail, among other projects. Likewise, since the South Boston Piers MEPA review is complete, it too can be such a resource since its financial analyses include Worcester Rail and all of Old Colony including the Greenbush line. What follows summarizes the relevant South Boston Piers and Greenbush financial discussions. However, this FEIR incorporates by reference those discussions, and all their supporting materials in their MEPA records, into this FEIR.

The South Boston Piers FEIS/R concludes that the MBTA's finances are sufficient to cover, through 2015–the horizon year of the analysis–the costs of maintaining current

operations and of funding planned MBTA expansions, including the Transitway itself, the Old Colony project and "other growth projects." *South Boston Piers FEIS/R,* EOEA #6826, pp. 6-9, 6-8. The analysis plan for assessing the MBTA's capacity to take on the Transitway, the most expensive and ultimately the chosen option in the *South Boston Piers FEIS/R,* was laid out in MBTA, *South Boston Piers/Fort Point Channel Transit Project,* Report No. 11, *Financial Analysis Methods Report,* prepared by URS Consultants, Inc., September, 1991. The actual fiscal capacity analysis was performed in MBTA, *South Boston Piers/Fort Point Channel Transit Project,* Report No. 20, *Results Report: Financial Feasibility,* Cambridge Systematics, Inc., with URS Consultants, Inc., April, 1992. Report No. 20 was summarized in the *South Boston Piers DEIS/SDEIR,* Ch. 6. Report No. 20's assumptions were updated for the *South Boston Piers FEIS/R* to reflect MBTA budget changes for FY1995 and an assumed 4.8% annual growth in future real state budget assistance and 5.1% annual growth rate in future real contract and additional state assistance. "Other growth projects" in the *South Boston Piers FEIS/R* financial feasibility model include "all MBTA capital projects included in the Authority's new five-year capital plan. This plan includes projects mandated by the SIP, by the CA/T Project Mitigation Plan, and by the ADA." *[South Boston Piers FEIS/R,* pp. 6-4, 6-5; See also *South Boston Piers FEIS/R, Response to Comments Appendix,* p. DEIS-34.]. This MBTA capital plan is the so-called program for mass transportation (PMT) required by the MBTA enabling act. See G.L. c. 161A, §5(g). Included in the PMT as one of the near-term SIP and CA/T mitigation projects is Worcester Rail, at an estimated capital cost of $119 million. Commonwealth of Massachusetts, Executive Office for Transportation and Construction, *Commuting in a New Century: The New Program for Mass Transportation,* Approved by the MBTA Advisory Board March 1, 1994, Appendix G, p. G-38; See also pp. 8-4 to 8-7, and Appendix G, pp. G-31 to G-41.

Building upon the financial analysis in the South Boston Piers FEIS/R, the Greenbush financial analysis also concludes that the MBTA is in sound financial condition and that, though 2015, it has the financial capacity to run the existing MBTA system, make improvements required by the Americans With Disabilities Act, and complete other new projects to which the MBTA has committed. *Greenbush SDEIS/R,* p. VI-2. These new projects include the Transitway, Old Colony excluding Greenbush, and Worcester. *Greenbush SDEIS/R,* p. VI-9. The South Boston Piers FEIS/R financial analysis was reviewed for the *Greenbush SDEIS/R* and updated to reflect the MBTA's FY1996 budget, some revisions to the PMT, and a revised assumption for annual growth (perhaps between 1995 and 2005 only) in future real state contract and additional assistance. *Greenbush SDEIS/R,* pp. VI-2, VI-4, VI-6. Since no Federal assistance is assumed for Greenbush, its capital and operating costs were determined to be feasible only if fitting within the long-term MBTA financial model incorporating this revised annual assistance growth rate, which itself was determined to fit within overall assumptions about the

growth of personal income and tax revenue in Massachusetts. *Greenbush SDEIS/R*, pp. VI-6. Also assumed in the model is flat Federal operating assistance, modest annual growth of 4.5% in fare and miscellaneous revenues, and local assessments rising at no more than 2.5% annually, the rate at which baseline property taxes in a municipality may lawfully rise annually. *Greenbush SDEIS/R*, pp. VI-2, VI-6. Federal capital grants roughly at current levels are also assumed--not unreasonably, given that these funds come largely from dedicated Federal revenue sources. *Greenbush SDEIS/R*, p. VI-7. Each Greenbush alternative other than No Build was determined to create additional MBTA costs not covered by the MBTA financial model used, thus requiring either new monies or the rescheduling of other projects' completions if Greenbush were to proceed now, or Greenbush's deferral until the current PMT items are concluded. *Greenbush SDEIS/R*, p. VI-12. However, given that Worcester must be operational by December 31, 1996, the MBTA has no current plans to reschedule it should Greenbush's construction require any project rescheduling. The *Greenbush FEIS/R* is expected to clarify that project's construction schedule and financing.

2.3 Conclusion

In reviewing the financial impacts of the preferred alternative, the commuter bus service alternative, and No Build, the MBTA has had to keep in mind not only these impacts and its policy goals for developing a regional transportation network, but the requirements of other state regulations and federal law. In response to a number of DEIR comments, by the Secretary and others, the MBTA wishes once again to point out, as it pointed out in the DEIR, that the preferred alternative in the DEIR for the Worcester Rail project is the same as the project required by DEP regulation 310 CMR 7.36(2)(c)2. Since the Worcester DEIR underwent MEPA review, this regulation, and the entirety of 310 CMR 7.36 of which it is a part, have achieved the additional status of becoming elements of the Commonwealth's State Implementation Plan (SIP) under the federal Clean Air Act by virtue of EPA action effective October 4, 1994, (59 *FR* 50495 *et seq.*). Opportunity for comment on DEP's and EPA's regulatory actions, by agencies or citizens, has long ago passed. The DEP regulations at 310 CMR 7.36(2)(c)2 require that the Framingham/Worcester commuter rail extension be operational before December 31, 1996. This requirement is enforceable under state and federal law, including by citizen suit.

Further provisions of 310 CMR 7.36 allow for the substitution of alternates to any project it lists, if the responsible agency acting through the Executive Office of Transportation and Construction (EOTC), can demonstrate that the project required by DEP regulation is "infeasible due to associated adverse engineering, environmental or economic impacts."

This further provision appears to rule out the No Build option. Nor, based on the analyses presented in the DEIR, the Railroad Right-of-Way and Layover Facility FEIR, and this FEIR, is the project, because of engineering or environmental impacts, infeasible. Instead, the proposed basic commuter rail service improves air quality over No Build, and also serves long-standing MBTA policy goals around the development of a viable public transportation system which affords the various regions around Boston equal access to its downtown. Particularly in light of these latter goals, any project which also advances the air quality requirements of the Commonwealth should be welcomed. The economic feasibility of Worcester Rail, both *per se* and in the context of overall MBTA and state transportation planning, has been demonstrated in section 2.2 above.

Since the Worcester Rail project is not infeasible; since the legislature has spoken to the desirability of the preferred alternative by virtue of its Worcester Rail authorization in the 1994 transportation bond bill; since the Boston MPO, in compliance with federal requirements, has determined the overall financial capacity of transportation agencies, including the MBTA, to maintain existing transit operations and new transit initiatives, including the Worcester Rail preferred alternative; since, in the SIP for ozone attainment by the 1999 deadline to which it is subject, the Commonwealth has committed to the preferred Worcester alternative as part of its compliance scheme--the MBTA petitions the Secretary to find, in the certificate on this FEIR, that financial questions concerning the project, including questions of cost-effectiveness, have undergone sufficient MEPA review. Such a finding would be consistent with the Secretary's *Greenbush SDEIS/R* certificate, in which it was pointed out that "[while] many commentaries have raised issues concerning project costs and the effective use of public resources [,...] and while those issues are essential considerations in the public decision-making process, they are not matters on which [the Secretary] ... can require further analysis under MEPA, let alone render a decision." Old Colony Railroad Rehabilitation Project, Greenbush Line Corridor, EOEA #5840, *Certificate of the Secretary of Environmental Affairs on the Supplemental Draft Environmental Impact Report,* June 1, 1995, p. 2, Footnote 3.

SECTION 3.0 PROJECT ELEMENTS

Introduction

Although this Final EIR addresses the construction and operation of commuter rail stations in Millbury and Grafton, it is presumed that, in addition to the Worcester Station (presently an interim station which will become ultimately a multi-modal facility at Union Station), local commuter stations will be constructed in Westborough, Southborough, and Ashland. The latter three stations are not anticipated to be in place by the end of 1996, but should be operational shortly thereafter.

Brief summaries of the status of the Framingham Terminal Development project and the results of the Regional Station Study and an update of the Worcester Layover Facility and Right-of-Way improvements are included in this section. Construction costs, including Conrail force account work, are summarized also. The MBTA Mitigation Policy, which was presented in the November 1994 Draft Environmental Impact Report (DEIR) and the July 1995 Final Environmental Impact Report (FEIR), is still the baseline for proposed mitigation.

A presentation of impacts east of Framingham, including reasonable mitigation measures, will be dealt with in a third Final EIR which will also cover the Westborough, Southborough, and Ashland Stations.

In order to understand the subject(s) of this Final EIR within the context of the whole project, the following Figure 3.0-1, Panels 1 through 9, Proposed Railroad Corridor Improvements has been included in this section describing project elements. The figure has not been revised since its publication in the July 1995 FEIR (as Figure 3.1-1)

Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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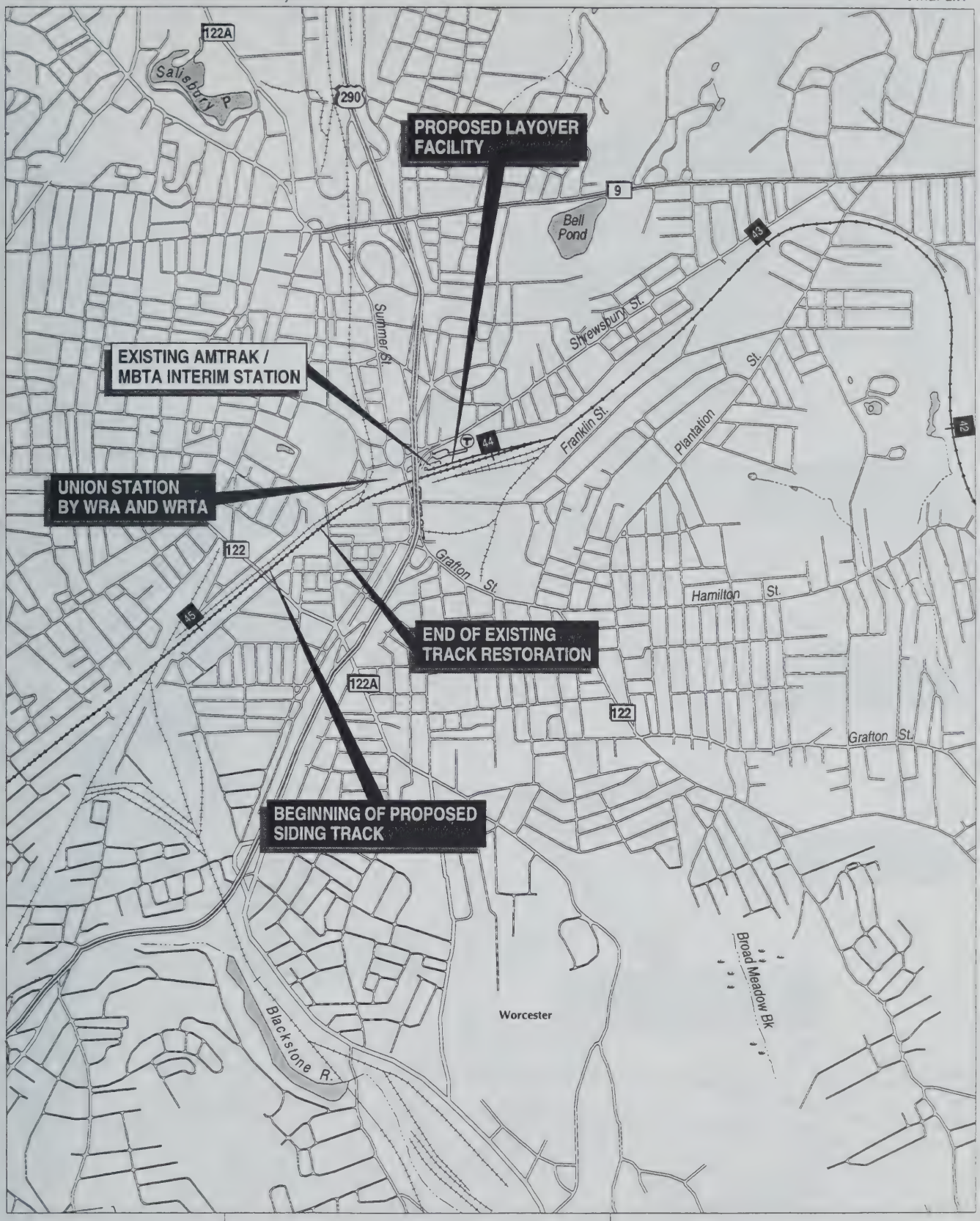
PROPOSED RAILROAD CORRIDOR IMPROVEMENTS

FIGURE 3.0-1 PANEL 1 OF 9



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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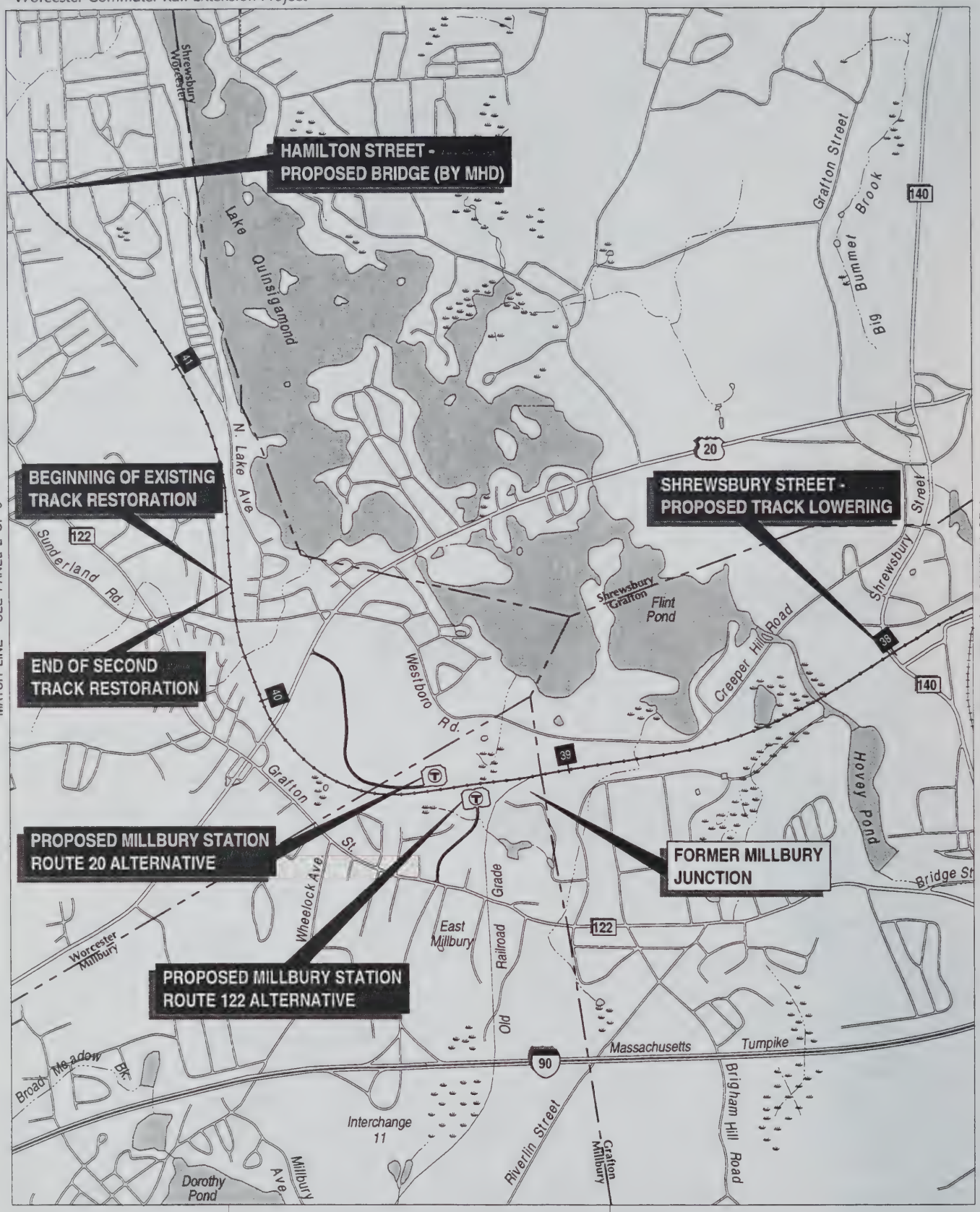
PROPOSED RAILROAD CORRIDOR IMPROVEMENTS

FIGURE 3.0-1 PANEL 2 OF 9



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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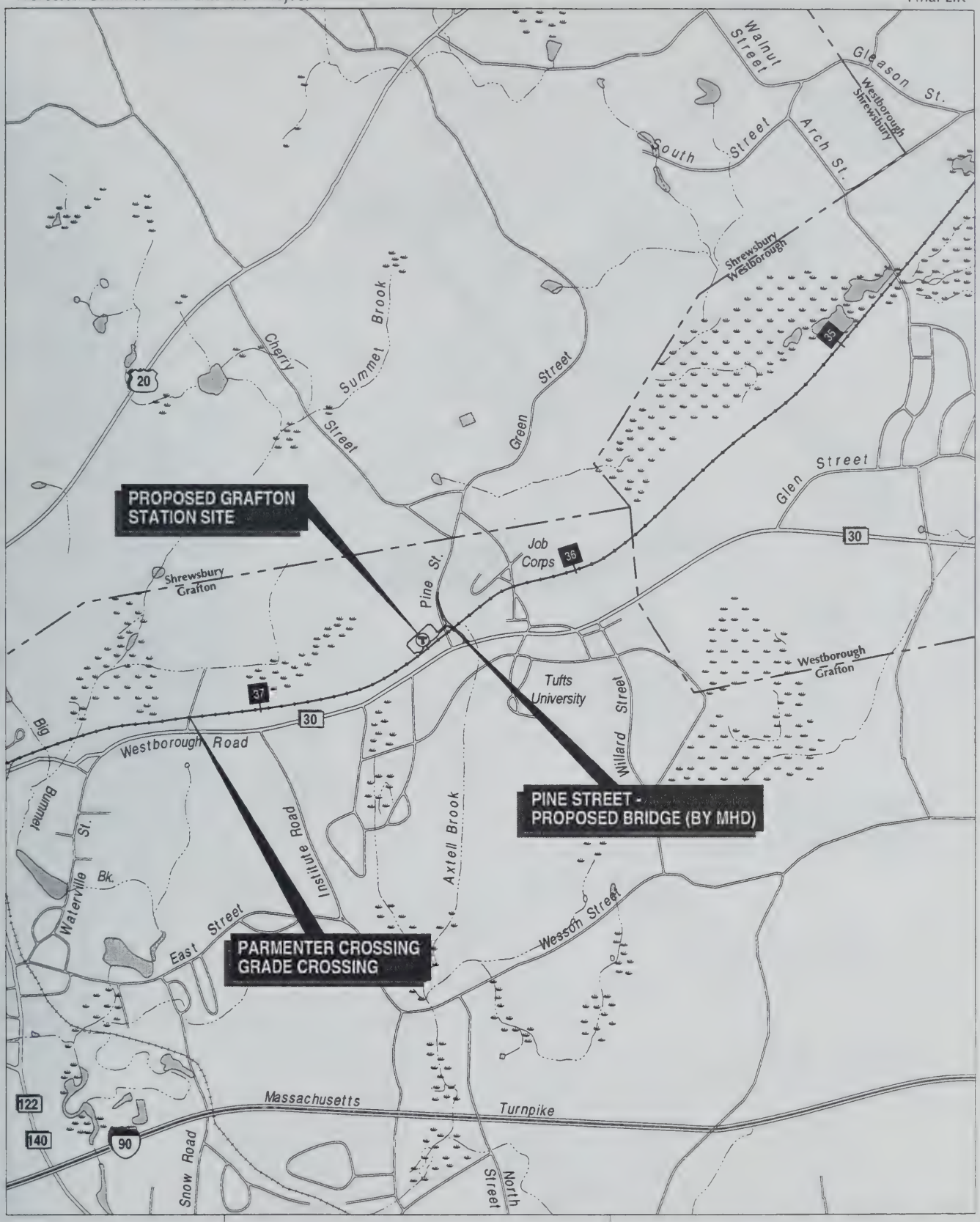
PROPOSED RAILROAD CORRIDOR IMPROVEMENTS

FIGURE 3.0-1 PANEL 3 OF 9



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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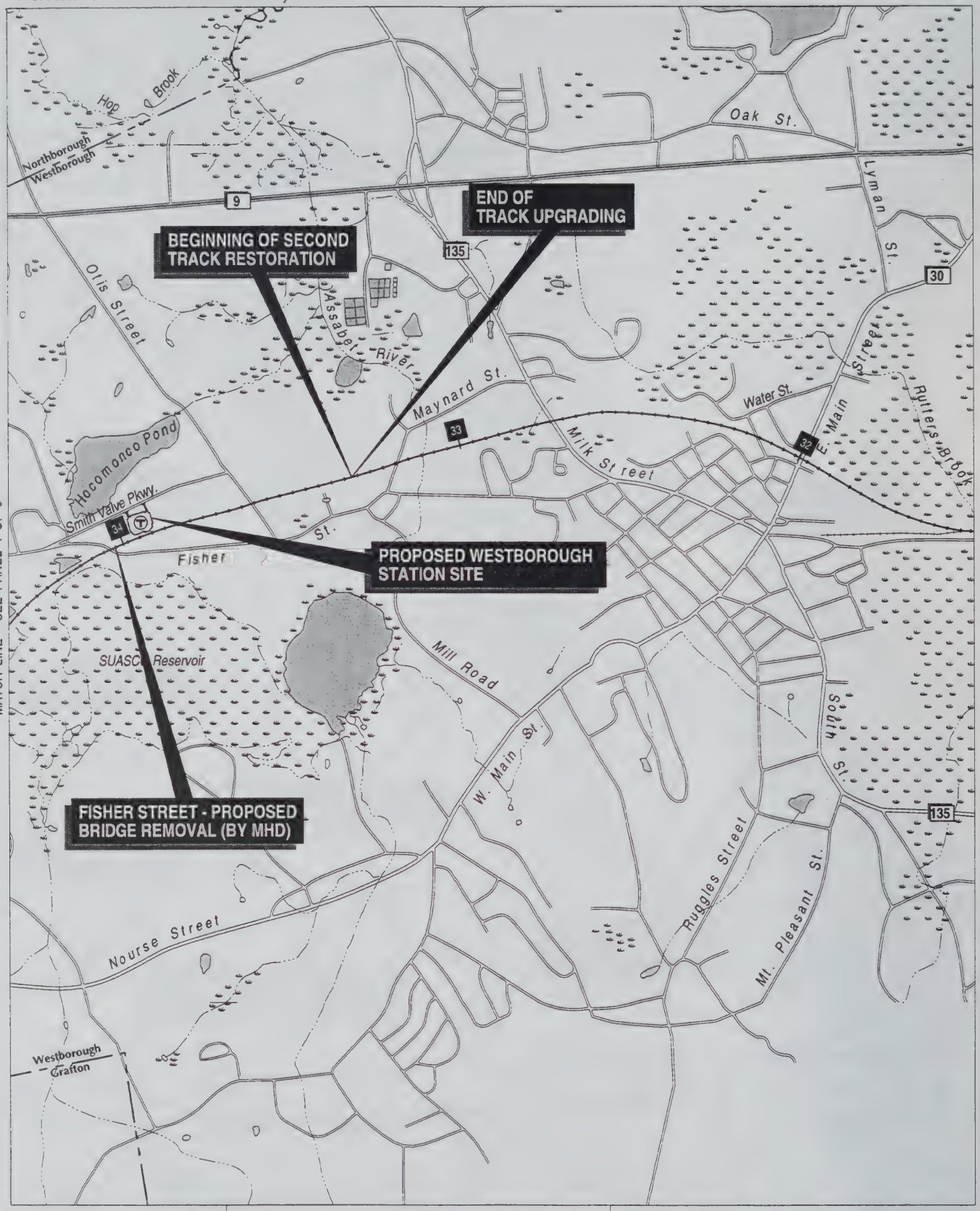
PROPOSED RAILROAD CORRIDOR IMPROVEMENTS

FIGURE 3.0-1 PANEL 4 OF 9



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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PROPOSED RAILROAD CORRIDOR IMPROVEMENTS

FIGURE 3.0-1 PANEL 5 OF 9

Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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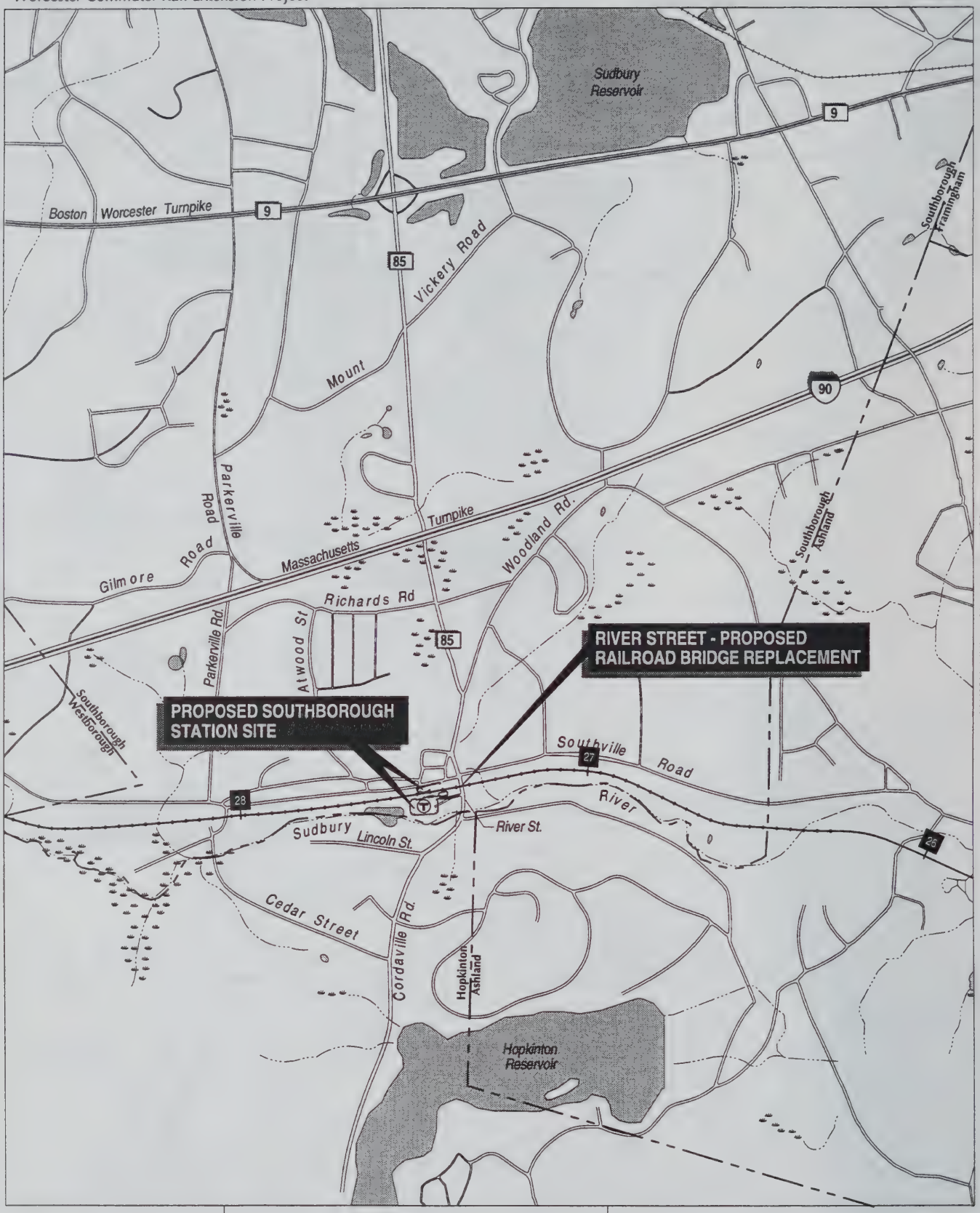
PROPOSED RAILROAD CORRIDOR IMPROVEMENTS

FIGURE 3.0-1 PANEL 6 OF 9



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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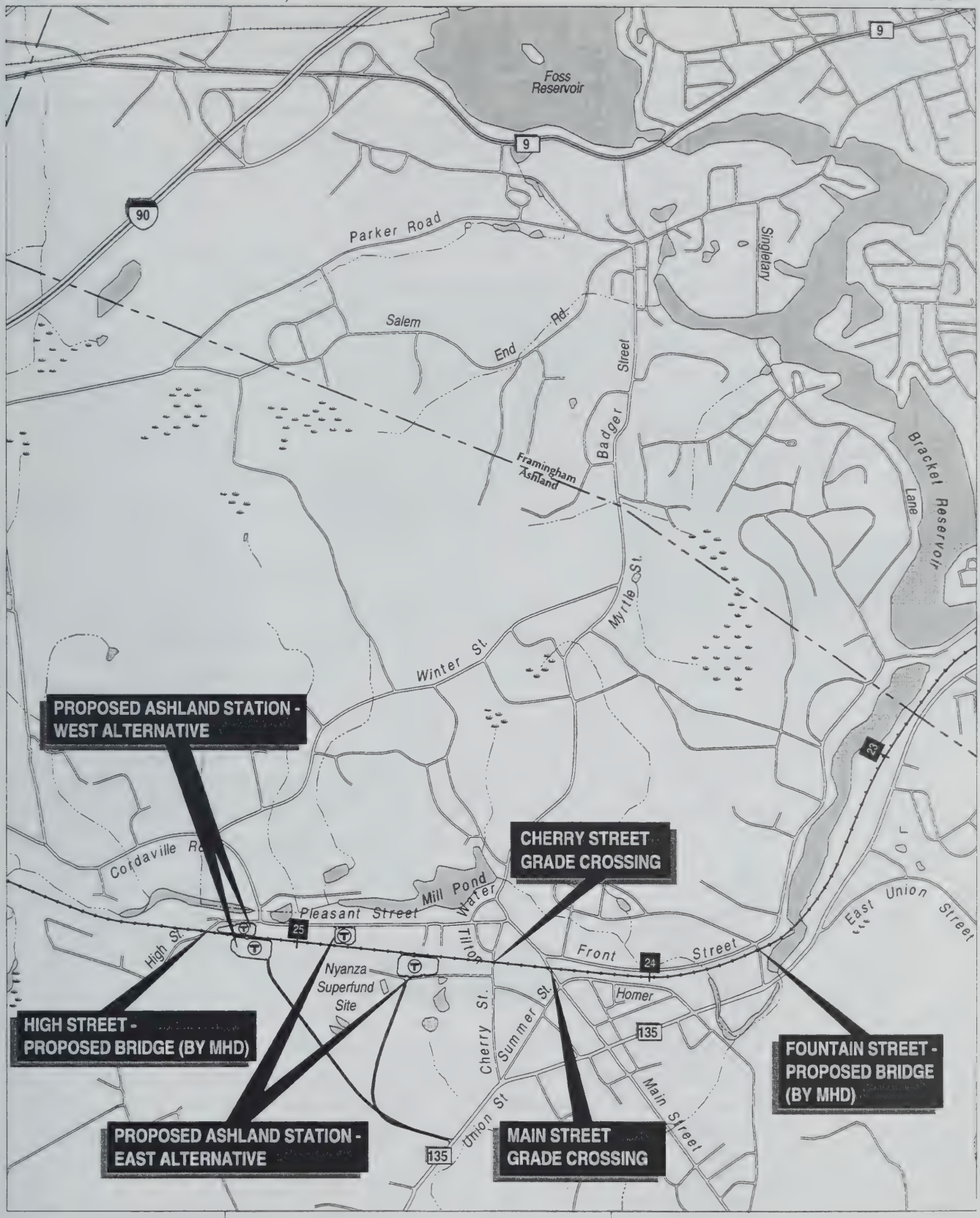
PROPOSED RAILROAD CORRIDOR IMPROVEMENTS

FIGURE 3.0-1 PANEL 7 OF 9



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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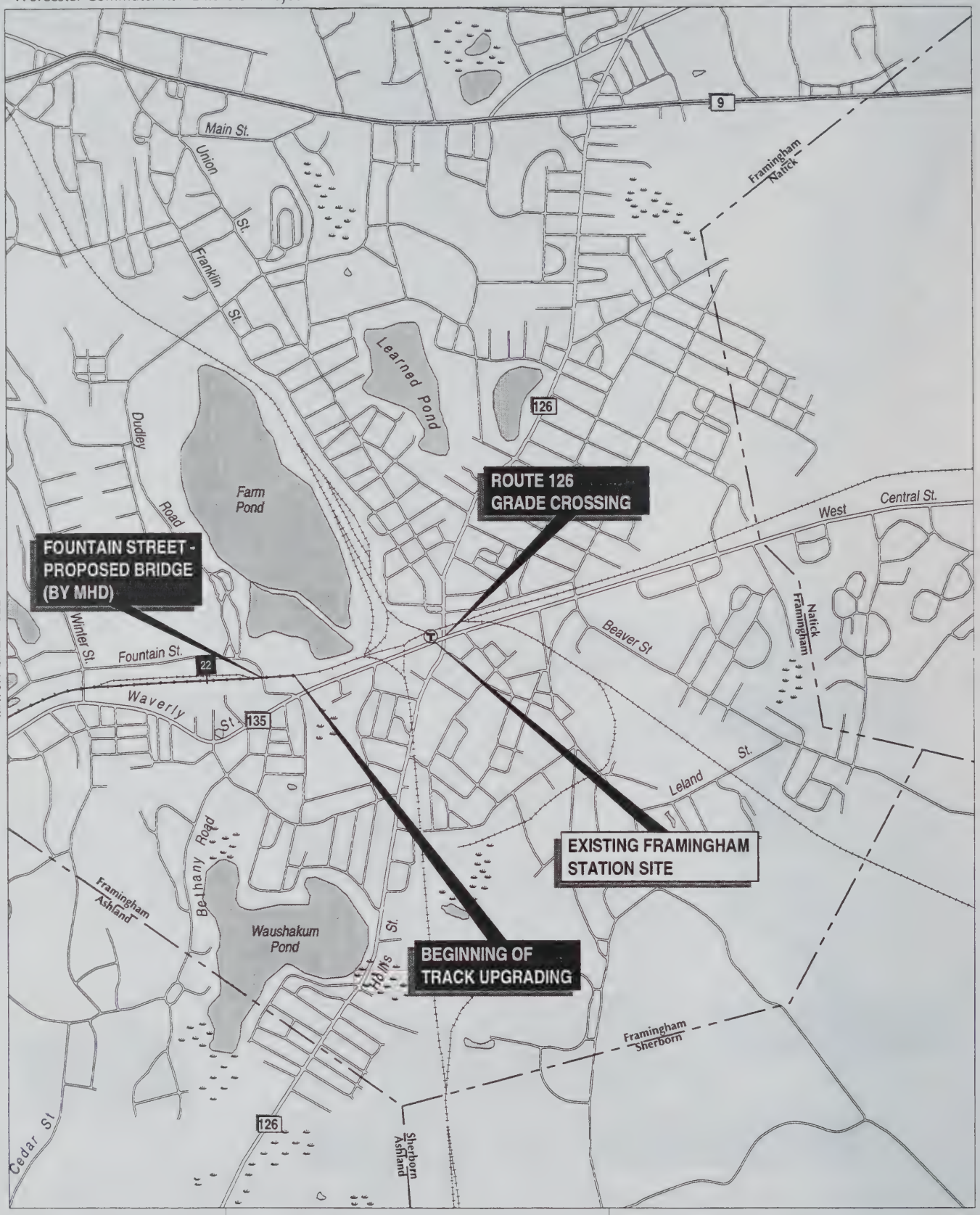
PROPOSED RAILROAD CORRIDOR IMPROVEMENTS

FIGURE 3.0-1 PANEL 8 OF 9



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

0 2000

PROPOSED RAILROAD CORRIDOR IMPROVEMENTS

FIGURE 3.0-1 PANEL 9 OF 9

3.1 Commuter Rail Stations - Millbury and Grafton

Millbury Station

Two alternative station sites were evaluated for the proposed commuter rail station in Millbury. The first would be accessed from Route 122 in East Millbury, opposite the ramp terminus from the Massachusetts Turnpike at Exit 11. The second station site would be accessed from Route 20 in Worcester. See Figure 3.1-1.

The Turnpike Exit #11 access road provides a direct connection to Route 122 within ¼ mile of the railroad tracks. Based on the success of the Exit 11 park and ride lot, there appeared to be good potential for a station in this area. Opposition to a Millbury site located on the south side of the tracks and accessed from Route 122 began after the MBTA formally presented its plan to the Town Selectmen. A local citizen's committee was formed and the Selectmen appointed leaders of the citizen's group to the Millbury MBTA Rail Advisory Committee. The Advisory Committee strongly opposed the Route 122 access and instead suggested a station site north of the tracks and accessed from Route 20 in Worcester. At the request of the Town of Millbury, the MBTA reduced the size of the parking area to 300 spaces and agreed to consider a station accessed from Route 20.

The location of the station platforms is very similar for both alternatives. The major difference between the alternatives is that one provides parking north of the tracks accessed via Route 20 while the other provides parking south of the tracks accessed via Route 122, opposite the MassPike Exit No. 11.

After meeting with the Advisory Committee and analyzing and weighing the potential impacts associated with each of the alternative locations, the MBTA has selected the Route 20 site as the preferred location. The driving forces for selecting this site were the reduced potential impact to local traffic, the anticipated positive effect on development in the Route 20 corridor, and general public acceptance.

The Route 20 site lies in a secluded area, just north of the tracks and somewhat westerly of the former Millbury Junction. The site is wooded and is bordered by the Worcester City line to the west and north, by a wetland resource area to the east, and by the railroad tracks to the south. The site slopes moderately in an easterly direction.

Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 800'

0 800

LOCUS MAP
MILLBURY STATION

FIGURE 3.1-1

The access drive will be a new 3,000-foot long roadway, beginning at a new intersection on Route 20 opposite the Big Y shopping center entrance. The westerly end of the station driveway will traverse industrial property. The location the roadway has been designed to minimize effects on truck access to the businesses, and no buildings will be acquired.

Near the Worcester City line, the access road traverses one house lot of a recent expansion of an existing residential subdivision. A new street, which was constructed in 1995, has not yet been paved, and the impacted lot is vacant.

The station will consist of 300 paved parking spaces, two 800-foot long platforms, including 45-foot long raised access platforms, a drop-off area, a pedestrian overpass, site lighting, landscaping, and bike racks. Intertrack fencing will be installed for the length of the station to discourage pedestrian crossing of the tracks. The station will be accessible to the disabled. The MBTA is currently seeking a variance from the MAAB to construct access platforms in lieu of full high level platforms.

Grafton Station

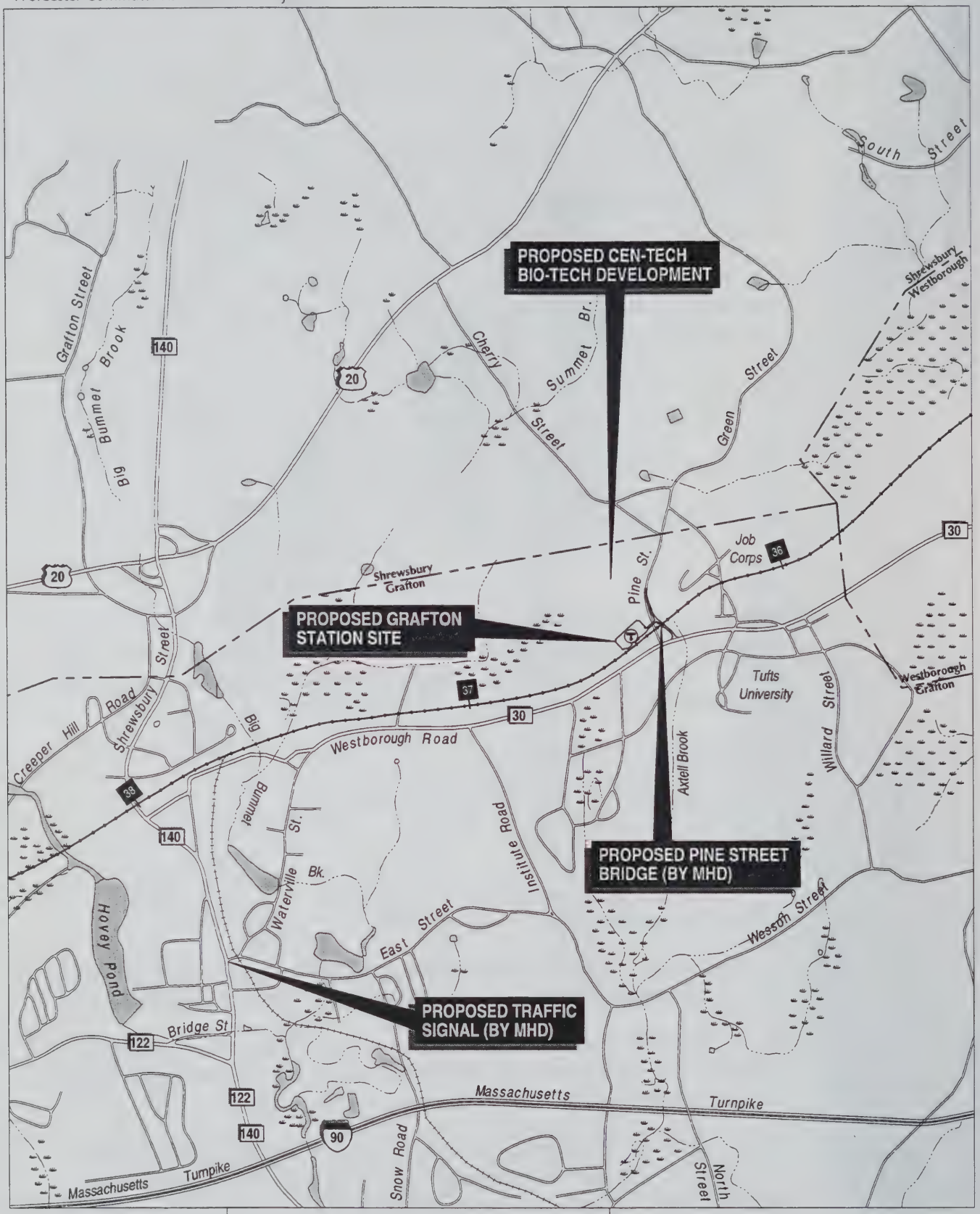
Several alternative station sites were evaluated for the proposed commuter rail station in Grafton, including the former station at North Grafton, a site at Parmenter Crossing, and a site at Tufts University as well as the proposed station location at Pine Street. The site at Pine Street was selected for the following advantages:

- Minimum wetlands impacts
- Minimum environmental impacts
- Feasibility relative to track alignment
- General public acceptance
- State-owned property
- Potential for future expansion
- Proximity to Tufts Veterinary School
- Proximity to proposed BioTech development

The Pine Street site is located on the north side of the tracks and the westerly side of Pine Street, approximately 300-feet north of Westborough Road (Route 30). See Figure 3.1-2.

The site area currently consists of approximately two acres of open meadow bordered by wooded areas on the north, east and west. The Conrail tracks abut the southern boundary of the site. Access is gained via a gravel driveway from Pine Street.

The proposed station will include approximately 265 paved parking spaces, two 800-foot long platforms, including 45-foot long raised access platforms, a drop-off area, a pedestrian overpass, lighting, landscaping, and bike racks. A new 200-foot long driveway



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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LOCUS MAP
GRAFTON STATION

FIGURE 3.1-2

will be constructed providing access to the site from Pine Street. Intertrack fencing will be installed for the length of the station to discourage pedestrian crossing of the tracks. The station will be accessible to the disabled. The MBTA is currently seeking a variance from the MAAB to construct access platforms in lieu of full high level platforms.

The Pine Street bridge adjacent to the station site is eligible for the Massachusetts Highway Department's ongoing program for replacement of functionally obsolete and structurally deficient bridges. Through interagency coordination, the MHD has agreed to schedule design and construction of the Pine Street bridge to be compatible with development of the commuter rail project. Design elements of the bridge project will include the following:

- Improved horizontal sight distance along Westborough Road (Route 30) from the proposed Pine Street intersection
- Increased Pine Street pavement width
- Provision of a sidewalk from Westborough Road to the station site

The bridge design work is being coordinated with Conrail and the Grafton Department of Public Works.

Construction Schedule and Sequencing

Construction of the Millbury and Grafton commuter rail stations will be consolidated into one contract. The contract is scheduled to be advertised in May 1996, with construction anticipated to commence in June and to be completed in December 1996. For both the Millbury and Grafton stations, access drives will be built first to facilitate access to the sites. Railbed improvements at the station sites were addressed in the July 1995 FEIR for the Railroad Right-of-Way and Layover Facility. Construction is in progress, as discussed in Section 3.5.

3.2 Framingham Terminal Development (EOEA No. 10106)

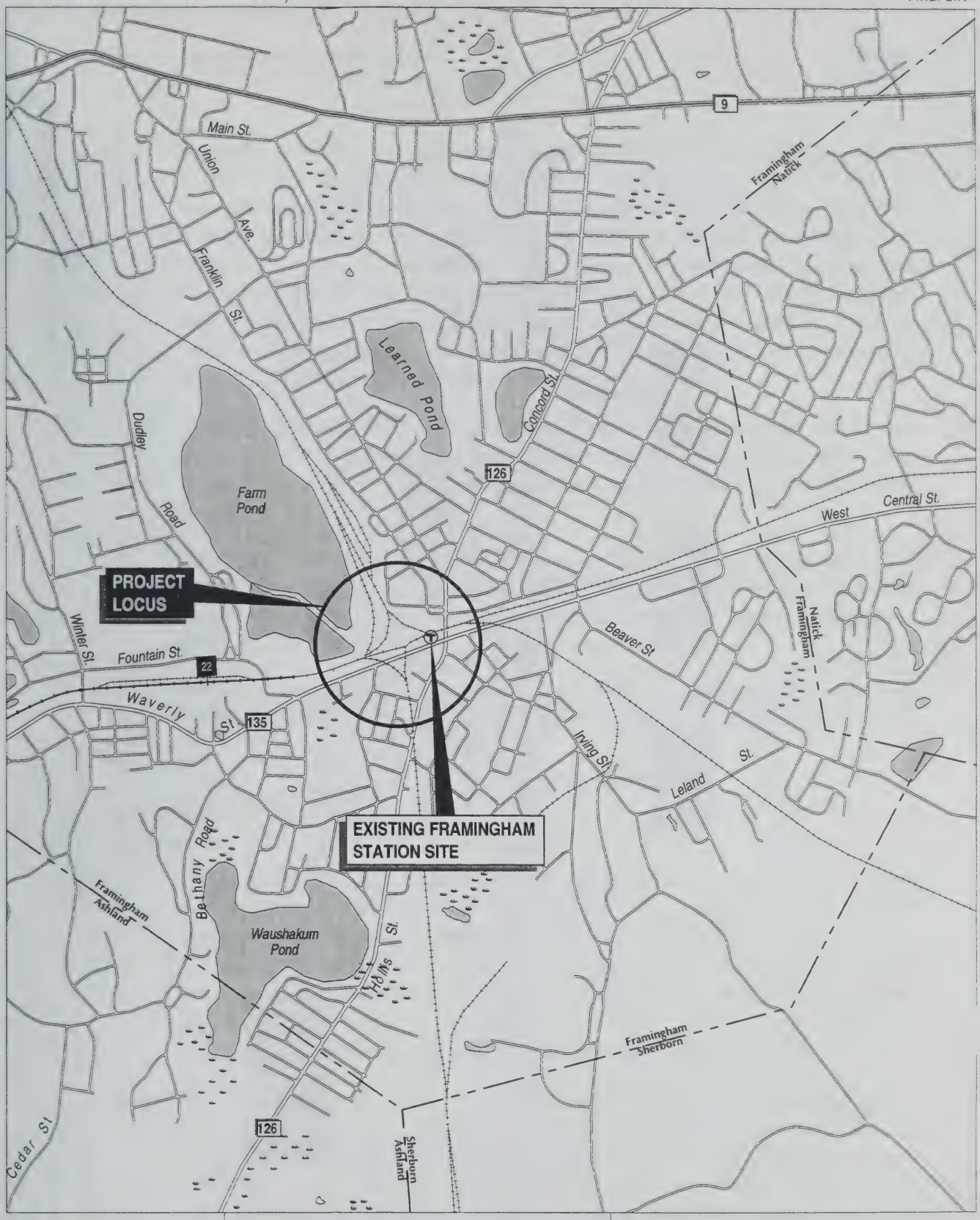
Framingham Terminal currently serves as the MBTA's regional terminus for Boston Metrowest daily commuter rail service. It is located within an active rail freight yard which is considered a local hub of Conrail operations. The project site is bounded by Waverly Street (Route 135) and Concord Street (Route 126) on the south and east

respectively, by the Conrail yard and the MBTA commuter parking lot on the northeast, and by Farm Pond on the northwest. (See Figures 3.2-1 and 3.2-2).

As presented in the Environmental Notification Form (ENF) for the Framingham Terminal Project, which was noticed in the Environmental Monitor on August 23, 1994, the proposed project is to improve commuter safety and accessibility, track operations and parking. The ENF addressed Phase 1 improvements only, including construction of a pedestrian overpass with handicapped access; extension of the commuter platforms with covered access; relocation of approximately 1,400-feet of track to increase track centers from a substandard 12 feet to 14 feet; installation of intertrack fencing; and construction of a commuter drop off/pick up area while increasing the 48 parking spaces off Waverly Street to 50 spaces (see Figure 3.2-2). Implementation of the Phase 1 improvements is anticipated in 1997 following completion of environmental clearance and final design.

Phase 2 improvements, which are considered an independent project from Phase 1, would include the construction of an additional 350 parking spaces in the Conrail north yard immediately north of the station platforms. Phase 2 is not currently programmed for construction. It is anticipated that a decision on Phase 2 will be driven by the need for additional commuter parking after the parking demand at Framingham is reduced significantly by the construction of commuter stations to the west in Westborough, Southborough, and Ashland.

The Secretary of the Executive Office of Environmental Affairs (EOEA) issued a Certificate on the ENF on September 22, 1994. The Certificate found that an Environmental Impact Report (EIR) would be required for the Phase 1 project. As proposed, the project involved the demolition of the existing platform canopy structure as a result of track relocation. Since the station building and related structures, including the canopy, are listed on the National Register of Historic Places, the project is categorically included thus requiring preparation of an EIR pursuant to MEPA Regulation 301 CMR 11.25 (20). The required EIR was ruled as limited to the potential impact to National Register elements and that other aspects of the Phase 1 project could proceed.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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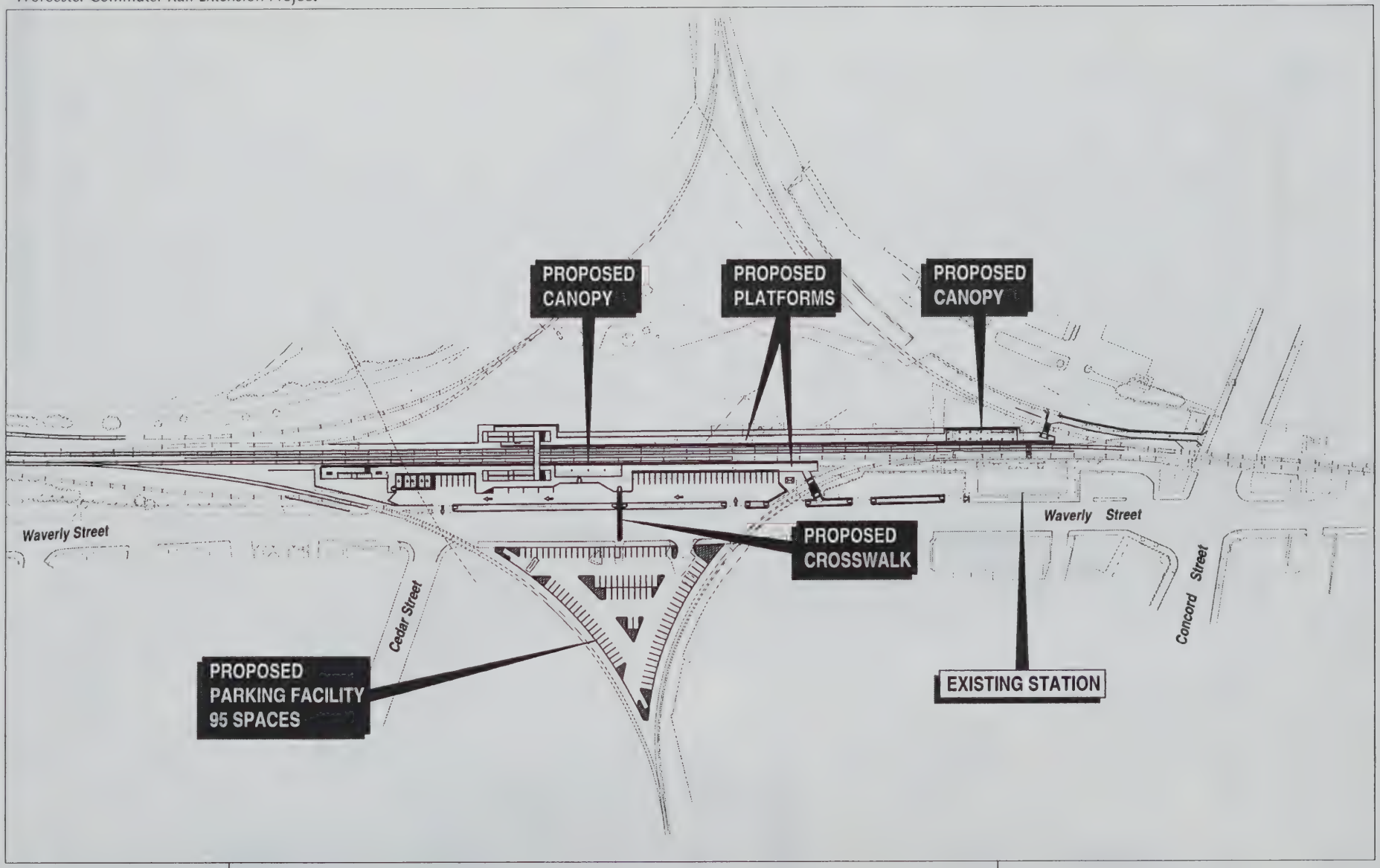
LOCUS MAP
FRAMINGHAM STATION

FIGURE 3.2-1



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 200'

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SITE PLAN
FRAMINGHAM STATION

FIGURE 3.2-2

In an effort to resolve the canopy issue, the MBTA submitted a Notice of Project Change on November 30, 1995. In the Notice it was revealed that the canopy would be removed, restored, relocated, and thus preserved. Supporting documentation, including a basic agreement for the canopy preservation in a letter from the Massachusetts Historical Commission, requested that the Secretary of EOEA reconsider the requirement for an EIR. Included in that presentation was a request to allow the MBTA to deal with traffic and parking concerns at Framingham as part of the ongoing MEPA review of the Worcester Commuter Rail Extension Project (EOEA No. 9154). In a Certificate issued on January 10, 1996, the Secretary agreed with the above request.

Since the issuance of the ENF, the Framingham Terminal Development has been revised to include the construction of approximately 95 commuter parking spaces on the south side of Waverly Street west of the Waverly Street/Concord Street Intersection (see Figure 3.2-2).

Other issues relating to the Phase 1 project, including pedestrian access, are considered to be still a part of that project and not part of the Worcester Commuter Rail Extension Project. The MBTA will resolve the issues under the Framingham Terminal Development (EOEA No. 10106).

Pertinent communications regarding the above matter, including the Notice of Project Change and the Certificate on the Notice, are included in Appendix B of this document.

3.3 Regional Station Feasibility Study

A Regional Station analysis as performed as part of the November 1994 Draft EIR (Section 17.0) for the Worcester Commuter Rail Extension Project. Issues presented included conflicts with wetlands, in particular designated Areas of Critical Environmental Concern (ACEC), access roadway and traffic concerns and the high cost. The MBTA made a decision that a regional station would be too costly overall, in particular for the small net gain in ridership, and would be impractical as a near-term goal in light of the anticipated environmental permitting process which was estimated to require several or more years.

The Massachusetts Legislature, in response to intense local interest, included a mandate in the 1994 Transportation Bond Bill which directed the MBTA to perform a feasibility study for a regional commuter rail station in the vicinity of I-495. The study has been performed separate from the Worcester Commuter Rail Extension Project, while employing pertinent information developed in the course of the Worcester project. In addition, the Central Transportation Planning Staff (CTPS) developed a variety of ridership scenarios with and without a Regional Station (see Appendix D).

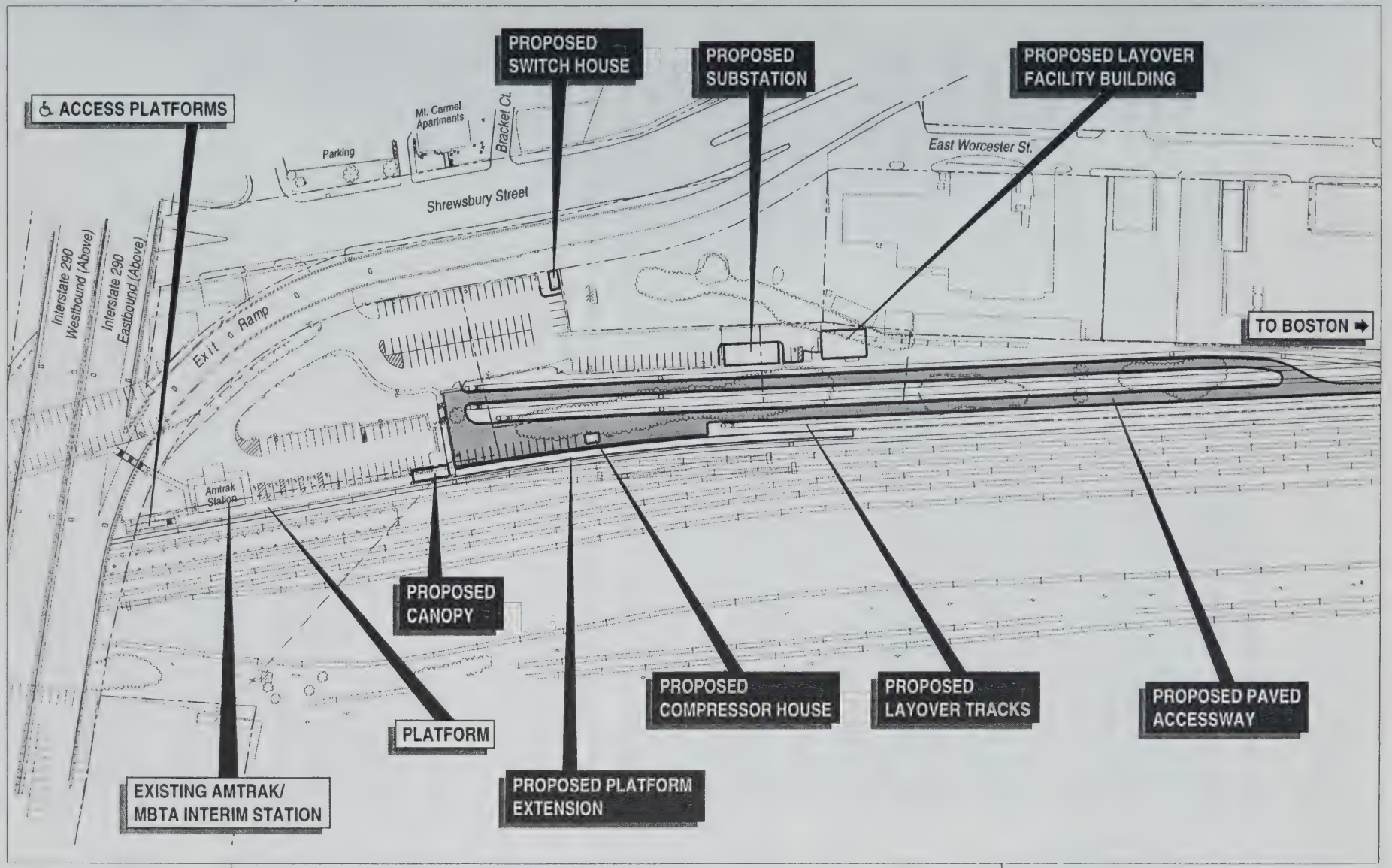
The study effort included the investigation and development of seven potential regional station sites in the I-495 area. Included in the study were eight options, which involved various combinations of a regional station with and without certain local stations. Based upon a site criteria list, developed in response to input from local residents and officials, alternative sites were selected for study. Against a background of land use, natural environmental considerations, traffic and access impacts, ridership estimates and economics, the practicality of all sites was evaluated. A draft of the study has been distributed to the appropriate regional and local agencies and officials and to interested citizens so that commentary can be addressed and included in the final document.

The results of the study focus on the same basic issues presented in the November 1994 Draft EIR. Environmental issues and traffic access concerns can favor one alternative versus the others, but station cost for all alternatives is excessively high. The question of feasibility can still be at issue depending upon the interpretation of the study results, but some underlying issues do come into play. The Town of Westborough, through its MBTA Rail Advisory Committee, was generally in favor of a local station at the Smith Valve Parkway site proposed by the MBTA. Eventually, due to concerns about traffic and safety expressed by residents living near the proposed station site, a non-binding vote at Town Meeting strongly opposed the Smith Valve Parkway site, and in fact any local station site, while voting overwhelmingly for a regional station or at least consideration of a regional station. Since traffic on local streets becomes an issue regardless of where a station is sited, regional or local, the Town has basically determined that they will not accept any station in Westborough. At present, a movement is underway to reverse the previous non-binding vote for no local station. Such a reversal could reveal that a majority of Westborough residents deem that a commuter rail station, especially a local station, would serve the people and growing business community as a valuable asset.

Regardless of individual preferences, the MBTA will come to a decision in the regional station matter. It is likely that the economics and the environmental impacts of the matter will provide the most guidance. In the meantime the MBTA will communicate with Westborough officials for additional input.

3.4 Layover Facility

The proposed layover facility is located adjacent to the Amtrak Station on Shrewsbury Street in Worcester. The facility is bordered by the Conrail yard to the south, by the Amtrak Station and Interstate Route 290 to the west, and several industrial properties fronting on East Worcester Street and Albany Street (including City of Worcester DPW yards) to the north (see Figure 3.4-1).



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 150'

0 150

SITE PLAN - LAYOVER FACILITY WORCESTER, MA

FIGURE 3.4-1

The proposed Layover Facility has been sited near the project terminus in Worcester in order to eliminate the movement of empty trains (deadhead movement) back to a central facility at night and out to Worcester each morning where the service initiates. The proposed site can accommodate four 9-car train sets, and will include a maintenance building, electric substation, compressor house and associated access driveways and employee parking areas.

The construction contract for the Layover Facility was advertised on June 23, 1995 and awarded in September 1995. Construction of the facility commenced in October 1995 and is scheduled to be completed on or about September 30, 1996. The contract provides for certain modifications and improvements to the recently constructed Worcester (Interim) Station including final paving of the main parking lot, extension of the passenger platform and additional lighting and signing for passengers. The Interim Station will continue to support Commuter Rail passenger service until such time as the future Union Station Project (now under design) is completed.

The Final EIR for the Railroad Right-of-Way and Layover Facility determined that the environmental impacts associated with the Layover Facility were modest and generally amenable to avoidance or mitigation. The major impact at the layover facility was attributable to noise, where an increase of about 1dBA in the day-night sound level is expected. In order to reduce this effect to the maximum practical extent, the MBTA has included in the construction contract provisions for wayside electrical power to eliminate the need for overnight idling of locomotives, which will virtually eliminate this potential noise source. In addition, the Layover Facility will include a wayside air compressor to maintain brake system pressures overnight, thereby substantially reducing morning warm-up idling requirements.

3.5 Railroad Right-of-Way

The MBTA Worcester Commuter Rail Extension service will operate over trackage owned and operated by Conrail. Although Conrail continuously maintains the rail corridor, upgrading and modifications to both the track and signal systems are required to accommodate the passenger service.

Much of the actual track and signal upgrade work is being performed by Conrail under a force account agreement with the MBTA. The remaining elements of the railroad right-of-way work is or will be performed under the MBTA construction contracts.

The MBTA "Trackbed Preparation" construction contract, which included preparing the trackbed for the seven mile section between milepost (MP) 33.2 in Westborough and MP

40.3 in Worcester, for the 1.4 mile section between MP 44.8 and MP 46.2 in Worcester, and installing signal conduit in Framingham, was advertised on July 28, 1995 and awarded in September 1995.

Notices of Intent were filed with the local Conservation Commission in each town in which the proposed work would occur. Mitigation measures were included in the Notices filed and in the Orders of Conditions issued. These mitigation measures generally included:

- Installation of erosion control barriers between existing wetland resource areas and area of proposed construction.
- Installation of ballast retaining walls to minimize lateral (perpendicular to tracks) extent of the proposed work and to redefine existing ballast limits.
- Hydroseeding and/or placement of erosion control matting along newly graded sideslopes.

Basic Service to all stations will result in vibration impact to 15 residents along the rail corridor between Framingham and Worcester (see full discussion in Section 5.2). After a careful review of potential vibration mitigation measures, the MBTA determined that ballast mats and other forms of so-called path control would not be effective against the primary low frequency content of ground-borne vibration. Source control, in the form of contractual maintenance of MBTA locomotive and passenger car wheels has been found to be potentially effective for mitigating potential vibration impacts. The MBTA employs a rigorous maintenance program for its trains and will provide the same maintenance program for equipment used on the Worcester service. Trackbed maintenance between Framingham and Worcester is, and will remain, the responsibility of Conrail. Federal regulations require that this mainline track be regularly maintained to ensure the safety of rail operations.

In conjunction with EOTC objectives of improving vertical clearances along the Worcester Line, track and/or bridge alterations will be made within the area of track replacement (between MP 33.2 and MP 40.3) to provide a through vertical clearance of 21 feet. These alterations include lowering of the track at the Shrewsbury Street bridge in Grafton as part of the aforementioned MBTA trackbed preparation contract. Since the trackbed preparation construction in the Shrewsbury Street area required reconstruction of both the eastbound and westbound tracks, the additional work involved in providing the desired clearance was a minor part of the overall reconstruction effort.

The Massachusetts Highway Department will be increasing clearances by reconstruction of bridges over Hamilton Street in Worcester, Pine Street in Grafton, High Street and

Fountain Street in Ashland, and Fountain Street in Framingham. The Fisher Street bridge in Westborough, now closed to traffic, will be removed by the MHD.

The Route 85 (River Street) railroad bridge will be replaced as part of the project to provide room for a sidewalk and for improved sight distance near the intersection with Southville Road and near the proposed access drive to station parking south of the tracks. The issue of vertical clearance under the bridge is of concern for MHD, Conrail, and the Town of Southborough. The bridge now has a posted underclearance of 11 feet. The MHD prefers an underclearance of 14'-6". If the roadway were under state control (this section of River Street is controlled by the Town of Southborough), a variance would be required for any clearance less than 14'-6". Conrail also prefers the 14'-6" clearance to reduce the possibility of their bridge being hit and damaged, but providing 14'-6" clearance by raising the tracks would require a significant amount of track work at a cost of several million dollars. The Town of Southborough recently has requested that the bridge underclearance remain at the existing clearance to eliminate the possibility of more and larger trucks causing impacts on local streets. At the present time, Conrail and the MHD have agreed to allow the existing underclearance to remain unchanged, but have requested the new bridge abutment footings be depressed to allow for lowering of the roadway in the future. A recent decision by the MBTA, in response to concerns about the aesthetic of the proposed pedestrian overpass at the Southborough Station, eliminates the pedestrian overpass and routes commuters via stairs or ramps to an oversized sidewalk under the proposed bridge.

3.6 Estimated Project Cost

Before the project proceeded to environmental review, it was the subject of a detailed feasibility report requested by the legislature. The feasibility report cost estimates do not reflect all the costs of the project as now proposed to MEPA, as the project has been somewhat redefined since the feasibility report. Two additional stations have been added, in Millbury and Southborough. These new stations will require additional signals and other infrastructure. Parking has been expanded beyond what the feasibility report covered. Revised cost estimates for required station access for the disabled have been incorporated. As currently proposed, the MBTA now estimates the project will cost $114 million, of which about $80 million will be for track and signal improvements, layover facility, stations and land acquisition costs, and impact mitigation, and $34 million for rolling stock. Table 3.6-1 provides a breakdown of the estimated costs. The MBTA plans to use state bond funds to cover the project's capital costs. Annual debt service will equal approximately $9.7 million, according to the MBTA's most recent estimate.

Table 3.6-1 Estimated Project Cost

Project Element	Estimated Cost	Project Element	Estimated Cost
Track and ROW Improvements		**Layover Facility**	
Trackbed Preparation	$4,500,000	Track and Fencing	$2,000,000
ROW Fencing	$300,000	Electrical System	$1,800,000
Bridge, Wall, Repairs	$1,850,000	Lighting	$250,000
Noise and Vibration Mitigation	$1,200,000	Drainage and Grading	$200,000
Conrail Force Account Work		Crew Quarters and Parking	$800,000
New Interlockings (CP 22 to Worcester)	$7,740,000		
Second Track MP 33-40	$12,575,000	**Station/Parking Development**	
Cab Signals ("Cove" to CP 22)	$2,300,000	Ashland	$4,610,000
New Storage Track	$1,800,000	Southborough	$3,220,000
New Crossover CP 45	$763,000	Westborough	$2,819,000
Retire CP 44	$707,000	Grafton	$3,045,000
Flagging	$755,650	Millbury	$3,306,000
		Worcester	$1,500,000
		Land Acquisition	
		(station sites and layover)	$7,000,000
Subtotal	**$34,490,650**	**Subtotal**	**$30,550,000**
Total Rail and Site			**65,040,650**
3% Project Administration and Field Inspection			1,951,220
12% Contingency			7,804,878
8% Engineering Design			5,203,252
TOTAL CONSTRUCTION ESTIMATE			**80,000,000**
Rolling Stock: (4 train sets)			34,000,000
TOTAL PROJECT COST			**$114,000,000**

The 1994 Transportation Bond Bill passed by the State Legislature authorized $78 million for the project's capital costs. The funding for the acquisition of locomotives and passenger coaches has also been funded by the legislature under the Acts of 1994.

3.7 MBTA Mitigation Policy

The basic rule of thumb regarding mitigation of impacts resulting from the implementation of MBTA construction projects and other actions is that "if the MBTA breaks it, we will fix it." This policy is applicable to both the on-site and off-site impacts of the Worcester Commuter Rail Extension project. This mitigation policy has been discussed at Town Rail Committee meetings and at Citizens Advisory Committee (CAC) meetings. However, not all impacts cause "breakage". For example, with respect to traffic impacts resulting from commuter station generated traffic, some additional traffic at intersections and on roadway segments may not result in a significant impact, especially if the intersection or roadway will still operate at an acceptable level of service (LOS). If station generated traffic degrades the level of service from LOS D or better to LOS E or LOS F, corrective action will be proposed. If an existing condition reveals an unacceptable LOS for an intersection or roadway segment, and the addition of station generated traffic materially worsens that condition, every reasonable effort will be made to correct the problem created by the additional burden, generally in cooperation with MHD or the relevant town, according to jurisdiction. However, to mitigate such that the original deficiency is corrected may be infeasible in some cases. Moreover, "fixing," again using the traffic example, means restoring an acceptable level of service, LOS D in the project area, though often traffic mitigation could result in improvements better than LOS D.

Noise and vibration impacts resulting from the addition of commuter train operations are evaluated in terms of Federal Transit Administration (FTA) criteria, supplemented by the Massachusetts DEP noise policy. Train noise that is considered highly annoying for a given land use category or that results in an increase of more than 5 dBA will be considered for noise abatement measures. Site specific evaluations will address potential control measures which could include a strictly enforced equipment maintenance program, sound barriers, and directional train horns. Although no vibration induced damage from train operations is predicted, ground-borne vibration generated by MBTA trains will result in the increase of vibration events per day, rather than higher levels. Where (depending on land use category) the increase in vibration events is considered to be significant, potential mitigation measures could include a strictly enforced equipment maintenance program and the installation of ballast mats.

Recently adopted MBTA policy provides for the expenditure of up to 2% of the project construction cost for noise and vibration impact mitigation. Consideration of the cost effectiveness of any noise mitigation measures must be weighted against the actual relief provided.

Wetland impacts will be mitigated through compliance with the appropriate regulatory requirements. The primary thrust of the right-of-way and commuter station design effort will be to avoid wetland, floodplain and drainage impacts. Where total avoidance is not possible, the design will seek to minimize any wetland alteration and, where alteration is unavoidable, will include construction methods and control measures to reduce short-term and long-term effects.

This FEIR will present mitigation proposals where applicable. Mitigation and local benefit possibilities will continue to be discussed with the relevant towns throughout the MEPA review and the design process.

SECTION 4.0 COMMUTER RAIL OPERATIONS

Introduction

The proposed commuter rail service between Worcester and Boston will be an extension of the existing Framingham to Boston service. The rail line between Worcester and Framingham is owned and maintained by Conrail. The proposed commuter service will share operations on the line with existing Conrail freight and intercity passenger service by Amtrak.

This section provides a summary of the implementation schedule, including Interim Service which commenced on September 26, 1994 and Basic Service which will commence by the end of 1996. Commuter rail fares and operating schedules are included also. Updated ridership estimates, prepared by the Central Transportation Planning Staff (CTPS), are summarized in this section. The complete ridership update is in Appendix D. The effects of the new commuter service are discussed relative to the existing Framingham to Boston schedule.

As part of railroad operations between Worcester and Framingham, right-of-way maintenance, in terms of vegetation control by the use of herbicides, was addressed in Section 7.5 of the November 1994 DEIR and in Section 4.5 of the July 1995 FEIR. Due to additional comments received on this matter, Section 4.5 of this FEIR provides a further discussion. Reference documents are included in Appendix E.

4.1 Implementation Schedule

As an extension of the existing Framingham - Boston commuter rail service, Interim Service to Worcester commenced on September 26, 1994. The new service provides three daily round trips between Worcester and Boston.

In addition to the construction and operation of commuter stations in Millbury and Grafton, this Final EIR addresses the institution of a Basic Service commuter schedule.

The new service will be in operation by the end of 1996 and will provide ten daily round trips between Worcester and Boston.

4.2 Commuter Rail Fares and Schedule

The proposed Worcester Extension fare structure is identical to that of other MBTA commuter rail lines, using a zone assignment for each station stop based on travel distance from the terminal station in Boston. Table 4.2-1 shows proposed zone assignments for new stations on the extension and the current fare structure for those zones; the fares shown are those pertinent to typical commuters to Boston.

Table 4.2-1 Proposed Zone Assignments and Fare Structure Worcester Commuter Rail Extension

Proposed Station	Proposed Zone	Fare Structure		
		One Way	12 Ride	Monthly Pass
Ashland	6	$3.50	$35.00	$112.00
Southborough	6	3.50	35.00	112.00
Westborough	8	4.00	40.00	128.00
Grafton	8	4.00	40.00	128.00
Millbury	8	4.00	40.00	128.00
Worcester	9	4.75	47.50	136.00

Under the provisions of the MEPA Certificate issued for the November 1993 Notice of Project Change, Interim Service to Worcester began on September 26, 1994. This service provides three trains in the A.M. and P.M. peak commuting hours traveling express between Worcester and Framingham. Approximate train departure and arrival times and station stops between Framingham and South Station are shown in Tables 4.2-2 and 4.2-3. The Interim Service schedule does not accommodate reverse commuting and there is no weekend service.

By late 1996, with the Millbury and Grafton stations in operation, the train schedule will be increased to provide the proposed Basic Service consisting of 10 operations in each direction per day. There will be four trains inbound to Boston during the A.M. commuting hours and five trains departing South Station during the P.M. peak hours. The approximate train schedules shown in Tables 4.2-4 and 4.2-5 and assume that all of the intermediate stations are constructed. In fact, only the Millbury and Grafton Stations will be on line by the end of 1996. Minor schedule adjustments will be necessary to allow for less total running time between Worcester and Framingham without stations in

Table 4.2-2 Interim Service - Worcester Commuter Rail Eastbound MBTA Trains Worcester to South Station

TRAIN	START TIME	ARRIVAL TIME	WORCESTER	MILLBURY	GRAFTON	WESTBOROUGH	SOUTHBOROUGH	ASHLAND	FRAMINGHAM	W NATICK	NATICK	WELLSQUARE	WELLHILLS	WELLFARMS	AUBURNDALE	W NEWTON	NEWTONVILLE	BACK BAY	SOUTH STATION
500	05:45 A.M.	07:02 A.M.	O						S	S	S	S	S	S	S	S	S	S	D
502	06:20 A.M.	07:25 A.M.	O						S	S								S	D
510	07:15 A.M.	08:20 A.M.	O						S	S								S	D

O = ORIGIN D= DESTINATION S= STOP

Table 4.2-3 Interim Service - Worcester Commuter Rail Westbound MBTA Trains South Station to Worcester

TRAIN	START TIME	ARRIVAL TIME	WORCESTER	MILLBURY	GRAFTON	WESTBOROUGH	SOUTHBOROUGH	ASHLAND	FRAMINGHAM	WNATICK	NATICK	WELLSQUARE	WELLHILLS	WELLFARMS	AUBURNDALE	WNEWTON	NEWTONVILLE	BACKBAY	SOUTHSTATION
517	04:55 P.M.	06:00 P.M.	D						S	S								S	O
521	05:30 P.M.	06:49 P.M.	D						S	S	S	S	S	S	S	S	S	S	O
523	06:00 P.M.	07:05 P.M.	D						S	S								S	O

O = ORIGIN D= DESTINATION S= STOP

Table 4.2-4 Basic Service - Worcester Commuter Rail Eastbound MBTA Trains Worcester to South Station

TRAIN	START TIME	ARRIVAL TIME	WORCESTER	MILLBURY	GRAFTON	WESTBOROUGH	SOUTHBOROUGH	ASHLAND	FRAMINGHAM	W NATICK	NATICK	WELLESQUARE	WELLHILLS	WELLFARMS	AUBURNDALE	W NEWTON	NEWTONVILLE	BACK BAY	SOUTH STATION
502A	06:00 A.M.	07:10 A.M.	O	S	S	S	S	S	S									S	D
504A	06:50 A.M.	08:00 A.M.	O	S	S	S	S	S	S									S	D
506	07:20 A.M.	08:40 A.M.	O						S	S	S	S	S	S	S	S	S	S	D
506A	07:40 A.M.	08:50 A.M.	O	S	S	S	S	S	S									S	D
510	08:10 A.M.	09:20 A.M.	O	S	S	S	S	S	S									S	D
514	11:30 AM	01:00 P.M.	O	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	D
518	03:05 P.M.	04:35 P.M.	O	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	D
520A	05:45 P.M.	07:05 P.M.	O	S	S	S	S	S	S	S	S	S	S	S				S	D
526	07:40 P.M.	08:50 P.M.	O	S	S	S	S	S	S									S	D
530	09:50 P.M.	11:20 P.M.	O	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	D

O = ORIGIN D= DESTINATION S= STOP

Table 4.2-5 Basic Service - Worcester Commuter Rail Westbound MBTA Trains South Station to Worcester

TRAIN	START TIME	ARRIVAL TIME	WORCESTER	MILLBURY	GRAFTON	WESTBOROUGH	SOUTHBOROUGH	ASHLAND	FRAMINGHAM	W NATICK	NATICK	WELLSQUARE	WELLHILLS	WELLFARMS	AUBURNDALE	W NEWTON	NEWTONVILLE	BACK BAY	SOUTH STATION
505	06:30 A.M.	07:50 A.M.	D	S	S	S	S	S	S	S	S	S	S					S	O
509	09:45 A.M.	11:10 A.M.	D	S	S	S	S	S	S	S	S	S	S	S				S	O
513	1:15 P.M.	02:45 P.M.	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	O
515A	04:25 P.M.	05:35 P.M.	D	S	S	S	S	S	S									S	O
519	04:40 P.M.	05:50 P.M.	D	S	S	S	S	S	S									S	O
521	05:25 P.M.	06:35 P.M.	D	S	S	S	S	S	S									S	O
521A	06:10 P.M.	07:20 P.M.	D	S	S	S	S	S	S									S	O
523	06:20 P.M.	07:50 P.M.	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	O
527	08:10 P.M.	09:40 P.M.	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	O
531	11:00 P.M.	12:30 A.M.	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	O

O = ORIGIN D= DESTINATION S= STOP

Westborough, Southborough, and Ashland. Assuming that the current Framingham arrival and departure times are maintained, minor adjustments would be made to the Worcester arrival and departure times.

The schedules are presented in this document so that train movements and layover facility functions can be addressed. The schedules have been adjusted since the DEIR to eliminate excessive turn-around time at Worcester during the off-peak hours.

The proposed Basic Service will include four A.M. peak hour trains making all stops between Worcester and Framingham, then express to Boston. The other six inbound trains also will make all stops between Worcester and Framingham (except one that is express to Framingham) and continue to Boston as part of the current Framingham to Boston scheduled service. The balance of the scheduled 15 trains from Framingham to Boston will be unaffected except for possible minor schedule adjustments.

Trains from Boston to Worcester will include four P.M. peak hour trains running express to Framingham, then making all stops between Framingham and Worcester. The other six outbound trains from Boston will make the regular Framingham line stops, then continue to Worcester making all station stops. The balance of the scheduled 16 trains from Boston to Framingham will be unaffected except for possible minor schedule adjustments.

Complete commuter train schedules between Worcester and Boston, including departure times at all station stops, are not included at this time for several reasons. Schedule adjustments are commonly made about twice each year. Although a reduction or an increase in the number of commuter trains would play a primary role in schedule adjustments, it is more likely that other factors would influence an adjustment. For example, activity at South Station, changes in the numbers or timing of Conrail freight runs, or changes in Amtrak service could affect commuter train schedules.

As an expansion of the Interim Service Schedule, Basic Service does not provide a true reverse commute schedule, nor does it provide for weekend service. Data available from other MBTA commuter lines reveal that reverse commute demand is quite small, usually 2% or less of the total ridership. If employment opportunities are concentrated in the vicinity of the outlying terminus of a commuter line, then reverse commute might be appropriate. At present, employment concentration in Worcester does not fit the basic concentration requirement since many of the jobs are accessed from I-290. If the picture were to change, the MBTA would entertain a further evaluation and possible institution of a reverse commute schedule. As for weekend service, the MBTA has received many requests for weekend rail service between Worcester and Boston. Presently, the MBTA's Railroad Operations Section is working with the Planning Department to develop a

schedule for Saturdays and Sundays. It is anticipated that such a service will be an extension of the Framingham-Boston weekend service, providing about half the number of weekday trains and carrying about 25% of the weekday patrons. Service could commence as early as January 1997. The service related impacts, although not quantifiable at this time, will involve impacts to local traffic and noise and vibration impacts along the right-of-way. These impacts will be less than the worst case traffic and noise/vibration impacts presented elsewhere in this FEIR for weekday commuter service. Positive effects on regional traffic and on air quality will result from the institution of weekend rail service to Worcester.

4.3 Commuter Rail Ridership

In response to comments on the November 1994 Draft EIR, and as input to the Regional Station Feasibility Study, the Central Transportation Planning Staff (CTPS) performed additional ridership analyses for the Worcester Commuter Rail Extension project. The travel demand forecasting procedures are the same as employed for the Draft EIR.

The analyses, contained in Appendix D of this document, address ridership projections for a variety of scenarios with and without a Regional Station for years 1996, 2001, 2006 and 2011. Different from previous ridership presentations is the inclusion of the Framingham Station ridership.

In terms of the proposed project, which includes a Worcester station and 5 intermediate stations, the ridership projections are the same generally as previously presented except for the inclusion of Framingham Station. See Table 4.3-1. Since this Final EIR addresses the short-term situation with a Millbury and Grafton Station only, the ridership projections for the year 1996 for that scenario are shown in Table 4.3-2. For the short term, Worcester and Millbury ridership is projected to increase slightly. At Grafton Station, the projected increase is substantial due to patrons who would normally use a Westborough local station going to Grafton temporarily.

Table 4.3-1 Ridership Projections With All Intermediate Stations*

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge

Year	Worcester	Millbury	Grafton	Westborough	Southborough	Ashland	Framingham
1996	369	149	115	222	506	769	709
2001	392	162	125	236	511	856	742
2006	421	177	136	252	513	973	814
2011	448	195	149	265	516	1085	881

* *Southborough constrained at 420 parking spaces*

Table 4.3-2 Ridership Projections With Millbury and Grafton Only

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge

Year	Worcester	Millbury	Grafton	Westborough	Southborough	Ashland	Framingham
1996	399	160	216	----	----	----	1363

Parking demand for the ridership projected in Table 4.3-1 is shown on Table 4.3-3. The interaction between Ashland and Framingham will require future monitoring after all local stations are in place. Phase 2 of the Framingham Terminal Development project would add up to 350 new parking spaces at the Framingham Station, if necessary.

Parking demand for the ridership projected in Table 4.3-2 is shown in Table 4.3-4. This demand will be short-term, as additional local stations are anticipated during 1997. Total ridership projections, with and without the Framingham Station, are shown in Table 4.3-5.

Table 4.3-3 Parking Demand With All Intermediate Stations

Year	Worcester	Millbury	Grafton	Westborough	Southborough	Ashland	Framingham
1996	290	120	90	180	420	610	360
2001	300	130	100	190	420	690	370
2006	330	150	110	210	420	780	430
2011	350	160	120	220	420	870	480

Table 4.3-4 Parking Demand With Millbury and Grafton Only

Year	Wor-cester	Millbury	Grafton	West-borough	South-borough	Ashland	Framing-ham
1996	310	130	180	---	---	---	690

Table 4.3-5 Ridership Totals - Worcester to Boston

Year	Without Framingham	With Framingham
1996	2,130	2,839
2001	2,282	3,024
2006	2,472	3,286
2011	2,658	3,539

"Without Framingham" is total daily boardings at Worcester and the five proposed new intermediate station. "With Framingham" totals adds the additional boardings at the Framingham station.

4.4 Effects on Existing Rail Service

Prior to the introduction of commuter rail Interim Service from Worcester in the Fall of 1994, Conrail freight and Amtrak intercity passenger trains ran on the tracks between Boston and Worcester and beyond. The three rail services now coexist in the corridor.

Between Boston and Framingham, the trains run on tracks owned by the MBTA. From Framingham to Worcester and beyond the tracks are owned and maintained by Conrail. Most of the existing mainline between Boston and Worcester is currently double tracked with continuous welded rail. The seven mile section between milepost (MP) 33.2 in Westborough and MP 40.3 in Worcester is single tracked. The eastbound track in this section was removed by Conrail in 1985. The second track is being restored as part of this project to accommodate safe, efficient operation of the three train services. In fact, even with Amtrak service reduced to one round trip daily, the second track is necessary for the increase in commuter trains from the Interim Service three round trips daily to the Basic Service 10 round trips daily. In addition, the eastbound track between MP 40.3 and MP 44.4, currently used by Conrail for a siding, will be upgraded, including new welded rail, as part of this project.

It was reported in the DEIR that, due to the introduction of Interim Service from Worcester, existing scheduled Framingham trains immediately before or after Interim Service express trains (2 of the 3 new trains would run express between Framingham and Boston) could lose some patronage to the express trains. No significant increase in boardings at the Framingham Station was anticipated. But, with daily boardings at Framingham in the order of 950 to 1,000 riders before Interim Service began, a significant increase to around 1,350 to 1,400 was observed in late 1994 and early 1995. The majority of the increased ridership has resulted from the introduction of express commuter service to Boston.

When the Basic Service commuter schedule is introduced in late 1996, two additional A.M. express trains will be offered departing from Framingham Station at 7:40 A.M. and 8:10 A.M. Once again, it is anticipated that a shift in ridership from non-express trains to express trains could result, but no significant increase in total ridership should occur.

The effects at Framingham Station, including the ridership demand, parking demand and additional gate closings at the track intersection with Concord Street, are addressed in Section 8.0 of this document. In addition, minor adjustments will be made to the Basic Service Schedule (See Tables 4.2-4 and 4.2-5) to account for less total running time without stations (for the short term) at Westborough, Southborough, and Ashland. The adjustments are likely at the Worcester Interim Station, thus maintaining the Framingham schedule.

4.5 Right-of-Way Maintenance

The November 1994 DEIR (Section 7.5) and the July 1995 FEIR, Railroad Right-of-Way and Layover Facility (Section 4.5), presented a brief discussion of the vegetation management plan for the Conrail owned and maintained track and right-of-way between Worcester and Framingham. Each of the above sections referenced the Vegetation Management Plan (VMP) and Yearly Operational Plan (YOP), which documents are prepared and issued in accordance with Massachusetts Rights-of-Way Management Regulations (333 CMR 11.00) administered by the Department of Food and Agriculture (DFA) under the Executive Office of Environmental Affairs.

The VMP is prepared by the Massachusetts Railway Association for railroad rights-of-way in the Commonwealth of Massachusetts. The plan covers all operating railroads including Conrail and MBTA commuter lines. The current VMP was approved by the Department of Food and Agriculture effective January 1, 1995 through December 31, 1999.

The VMP describes a variety of operational practices which include physical, chemical and natural methods used to manage, control, and eradicate vegetation on railroad rights-of-way.

Federal law requires railroads to control vegetation so that it does not become a fire hazard, obstruct visibility of railroad signs and signals, interfere with normal trackside duties, prevent proper functioning of signal and communication lines, and prevent railroad employees from visually inspecting moving equipment from their normal duty stations. State law, administered by the Department of Public Utilities, requires that the safety of railroads must be guaranteed by maintaining properly the right-of-way, which includes vegetation control.

The purpose of the VMP is to present the operations, processes, procedures and professional guidelines involved in the railroad's overall vegetation management program. A 10-fold decrease in herbicide application between 1950 and 1980 was the combined result of research and development and concern regarding possible adverse effects on man and his environment. Another 3-fold decrease was accomplished in the last eight years. The long-term goal of every VMP is to reduce the need for vegetation management, particularly the application of herbicides near sensitive areas. But, to date, no environmentally and economically feasible and safe alternatives to herbicides have been developed for use in right-of-way areas, such as the trackbed and other specialized areas, which require total vegetation control.

Sensitive areas are defined in 333 CMR 11.00. Most emphasis is placed on the sources of public and private drinking water supply, but also includes flowing water, wetlands and agricultural or habitated areas. Only approved herbicides can be applied near sensitive areas, with specific restrictions on a safe offset distance. The Massachusetts Department of Environmental Protection, Division of Water Supply, has been involved in the process through the identification and location of wells and surface water supplies throughout the Commonwealth. The identification and delineation of wetlands is performed in accordance with the guidelines of local, state, and federal agencies.

Site reviews, office procedures, preparation for herbicide application, daily field reports and herbicide application logs are all closely controlled aspects of the VMP. The companion document to the VMP is the Yearly Operational Plan (YOP) of each railroad which falls under the VMP. Conrail's approved plan for 1995, which is fully compliant with the VMP but offers more specific information regarding sensitive areas, no-spray areas, limited-spray areas, non-sensitive areas and herbicide application techniques and alternative control procedures, has been revised for 1996 and submitted to the DFA for processing and approval. The YOP was noticed in the Environmental Monitor on January 10, 1996. Under the 1996 plan, brush control will be limited to manual or mechanical

cutting in sensitive areas. The issuance of the YOP is made whether or not a railroad plans to apply herbicides. In fact, Conrail is lately promoting an alternate year program where herbicides are applied only every other year. For example, in 1996 it is possible that no herbicides will be used. The issuance of the plan is noticed in the EOEA's Environmental Monitor and notices are sent to each involved community, including but not limited to the Mayor, Selectmen, Board of Health, and Conservation Commission. Municipal agencies and officials have 45 days to review the YOP. A review of sensitive area maps will verify the accuracy of sensitive area locations, or will call for corrections to be made by the applicant prior to plan approval. Sensitive areas are checked and updated prior to herbicide application as part of the notification process and checked with the DFA regarding public and private drinking water supplies. In addition, prior to the application of herbicides, sensitive area markers are upgraded which includes cleaning, painting, or replacing just before application. Public notification of herbicide application to the right-of-way is made by certified mail at least 21 days in advance of the treatment.

Conrail, who owns and maintains the railroad right-of-way between Framingham and Worcester, has in place an approved VMP and companion YOP which are not affected or influenced by the MBTA Commuter Rail operations. Concerns expressed regarding the control of vegetation are, for the most part, responded to by reference to the VMP and VOP and the above presentation. If any specific comments require further response, see Appendix - Volume I. Copies of the Massachusetts Railway Association's VMP and Conrail's YOP are contained in Appendix E of this document.

SECTION 5.0 IMPACTS OF SERVICE

Introduction

By the end of 1996, the Worcester Extension Basic Service will provide 10 round trips daily between Worcester and Boston (See Section 4.2). Since only the Millbury and Grafton stations will be in service (Westborough, Southborough, and Ashland local stations anticipated to be built in 1997), certain effects will be temporary as opposed to the effects of full implementation of the proposed project. Regional air quality will benefit, but to a lesser degree than for full project implementation. Noise and vibration will be different for the short term without stations in Westborough, Southborough, and Ashland. Gate closings at grade crossings in Grafton, Ashland, and Framingham will result in traffic impacts from Basic Service commuter train operations. The number of gate closings will be the same regardless of which commuter stations are in operation. An update of historic and archaeological resources is included in this section. Appropriate mitigation measures are presented in Section 5.5.

5.1 Regional Air Quality

The regional air quality study conducted to evaluate the impact of the proposed Worcester Commuter Rail Extension Project consists of three analyses which quantify the various components of air quality impacts. These analyses look at the effects the commuter rail extension would have on overall air quality and compares them to a present and future without the commuter rail extension. The individual air quality analyses are as follows:

- Impacts of Auto Trip Diversion to Commuter Rail
- Impacts of Auto Trip Diversion on Peak Hour Massachusetts Turnpike Operations
- Impacts of Commuter Rail Operations

The combined effects of these three components of the air quality analysis represent the net estimated air quality impact of the various alternatives. The alternatives analyzed are as follows:

- No Build 1996;
- No Build 2001;
- Build 1996 Millbury and Grafton Stations Only (and Worcester);
- Build 1996 All Stations;
- Build 2001 All Stations.

The following sections provide the specifics of the analyses as well as a discussion on the findings.

Impacts of Auto Trip Diversion to Commuter Rail

An analysis of the impacts of a mode shift from automobile to the Worcester Commuter Rail Extension under a "Build" scenario was conducted and compared to a "No Build" scenario in which the trips diverted to commuter rail would otherwise have traveled to downtown Boston via automobile for years 1996 and 2001.

The ridership data used in this analysis was based on the *"Worcester Commuter Rail Extension Project Ridership Estimates,"* produced by Central Transportation Planning Staff, October 1995 (Revised January 1996). These estimates quantified commuter rail trips attracted to the various proposed stations for the Worcester Commuter Rail Extension. This ridership data for the air quality analysis is provided in Appendix G of this FEIR.

The analysis calculated the regional round trip emissions produced by vehicles which would travel from the various towns of trip origin into Boston under the "No Build" scenario and compared these emissions with those produced by trips to the various Worcester Commuter Rail stations necessary to access the rail service under the various "Build" scenarios. The difference between the emissions produced by auto trips into Boston under a "No Build" scenario and the emissions produced by trips accessing the commuter rail stations under a "Build" scenario accounts for the primary regional air quality benefit of the commuter rail extension.

Analysis Assumptions

- CTPS ridership estimates are person trips and have been converted to vehicle trips using a vehicle occupancy for work trips of 1.2 passengers per vehicle for travel to Boston and 1.12 passengers for travel to the various commuter stations.

- Automobile diversion is assumed to consist of 85 percent of the ridership estimates. The remaining 15 percent is assumed to be diverted from existing bus service.

- All park-and-ride trips were assumed to involve one round trip from the town of origin to the station and back; all kiss-and-ride trips were assumed to consist of two round trips to the station to account for drop-offs and pick-ups.
- All kiss-and-ride trips for each station were assumed to originate within the town in which the station is located.
- Walk trips for each station were subtracted from trips originating from the town in which the station is located.

Average travel distances between trip origins and downtown Boston for the "No Build" scenario and between trip origins and the proposed commuter rail stations in the "Build" scenario were based on measurements of travel distances taken from regional highway maps. Trips were assumed to originate from the town center and travel via primary and arterial roadways to their destination. All trips to downtown Boston were assumed to utilize the Massachusetts Turnpike from the Turnpike entrance nearest to the trip origin to the Turnpike's downtown terminus. Distances used in the analysis are presented in Appendix G.

Travel speeds for the identified travel routes were based on the default speeds established by the Federal Highway Administration's Highway Performance Monitoring System (HPMS) for the appropriate highway functional classes, except for the section of the Turnpike located between Route 128 and downtown Boston. The vehicle speeds associated with this section were adjusted for 1996 and 2001 to reflect the growth in Vehicle Miles Traveled (VMT), resulting in lower speeds for the "No Build" scenario and to account for reduced growth in traffic for the "Build" scenario resulting from auto trip diversions. The speed data for the Turnpike between Boston and Route 128 were based on the *"High Occupancy Vehicle Lane Feasibility Study,"* prepared by the Massachusetts Turnpike Authority in August 1993 (Revised April 15, 1994). Generation of speeds for 1996 and 2001 was completed using *Highway Capacity Software, Release 1.51*. This process is discussed in more detail in the following section discussing the Massachusetts Turnpike operations.

These speeds were used as input to the EPA's Mobile5a emissions model along with the official air quality program assumptions used by Massachusetts Department of Environmental Protection (DEP). The programs modeled are as follows:

- Year 1996: Massachusetts specific VMT mix and fleet age distribution; basic vehicle inspection and maintenance program; Stage II refueling program; reformulated fuel.
- Year 2001: Massachusetts specific VMT mix (different from 1996) and fleet age distribution; enhanced vehicle inspection and maintenance program; anti-tampering

program; pressure and purge check programs; Stage II refueling program; reformulated fuel; and California LEV program.

In practice, it is unlikely that all trips to downtown Boston would use the Massachusetts Turnpike. Use of secondary roadways would result in lower vehicle speeds and thus higher emission rates. Therefore, diversion of these trips to the commuter rail would result in even greater emission reduction benefits than are estimated based on an assumption that all diverted trips utilize the Turnpike.

Analysis Results

This analysis quantifies the regional reduction in VMT associated with the commuter rail extension and calculates the resulting reduction in daily emissions. Total daily regional VMT will be reduced as follows:

- By more than 50,000 VMT for 1996 Build Millbury and Grafton Stations Only (and Worcester);
- By more than 100,000 VMT for 1996 Build All Stations; and
- By more than 107,000 VMT for 2001 Build All Stations.

The greatest reduction in the emission of pollutants resulting from these VMT reductions is realized in 1996 Build All Stations , as follows:

- Net reduction of VOC of more than 122 kilograms per day;
- Net reduction of NOx of more than 193 kilograms per day; and
- Net reduction of CO of more than 1,214 kilograms per day.

Approximately one-half of the All Station reduction will be achieved under the Millbury and Grafton Station Only Scenario. The pollutant reductions in year 2001 are lower then in 1996 due to the more stringent emission controls which will be in place for vehicles by year 2001 (see year 2001 air quality program assumptions above). As a result, average emission rates per VMT are lower in 2001 than in 1996. The complete results of the analysis are shown in Table 5.1-1

Table 5.1-1 Comparison of Daily Regional Emissions (Kilograms/day)				
	VMT	VOC (Kg.)	NO_x (Kg.)	CO (Kg.)
No-Build (Town Center to Boston)				
1996 Millbury and Grafton Only (and Worcester)	56,425	74	108	745
1996 All Stations	116,289	143	221	1,379
2001 All Stations	124,360	81	180	815
Build (Town Center to Station)				
1996 Millbury and Grafton Only (and Worcester)	5,702	8	12	83
1996 All Stations	15,744	21	28	165
2001 All Stations	16,954	12	22	97
Net Daily Reduction				
1996 Millbury and Grafton Only (and Worcester)	50,723	66	96	662
1996 All Stations	100,545	122	193	1,214
2001 All Stations	107,406	69	158	718
VOC and NO_x emission rates are based on summer conditions. The CO emission rate is based on winter conditions.				

Impacts of Auto Trip Diversion on Peak Hour Massachusetts Turnpike Operations

This analysis calculates the impacts associated with the increased travel speeds on the Turnpike. The same set of alternatives were analyzed as for the analysis of diversions to commuter rail. The "No Build" alternatives assumed reduced Turnpike speeds due to growth in traffic volumes over time. The "Build" alternatives incorporated the reduction in traffic volumes associated with the Worcester Commuter Rail Extension ridership estimates into this normal growth to calculate the benefit of diverted auto trips.

Analysis Assumptions

Data for this analysis was taken from the *"High Occupancy Vehicle Lane Feasibility Study,"* prepared by the Massachusetts Turnpike Authority in August 1993 (Revised April 15, 1994). The data were used and adjusted as follows:

- 1996 and 2001 traffic volumes for the A.M. and P.M. peak hours were calculated based on the 1990 base year data and the 2020 forecasts.

- The "Build" scenario assumed adjusted traffic volumes on each segment based on the ridership estimates provided by CTPS (adjustment of ridership is discussed below).
- Speeds and Levels of Service (LOS) for the turnpike segments were calculated by the FHWA's *Highway Capacity Software, Release 1.51*, which is based on the *Highway Capacity Manual*. This was done for both "Build" and "No Build" scenarios.
- The turnpike segments were used as defined in the HOV study.

Three sets of Worcester Commuter Rail ridership forecasts were used in this analysis. Again these forecasts are presented in Appendix G. These numbers have been adjusted as follows:

- 85 percent of all trips were assumed to account for automobile diversion, with 15 percent from existing bus service.
- 65 percent of all trips were assumed to account for diversion from the Turnpike. (The remaining 35 percent is assumed to travel by alternate routes. This assumption results in a comparatively conservative estimate of impacts).
- 54 percent of all trips were assumed to account for peak hour movements.
- Vehicle occupancy was assumed to be 1.2 persons per vehicle.

These adjustments provided peak hour reductions in traffic volumes for both A.M. and P.M. peak hours and are presented in Table 5.1-2 (The same number of trips are subtracted from the A.M. and P.M. traffic). There are no traffic volume reductions presented for Millbury and Grafton Stations Only in 2001 because all local stations are assumed to be in operation prior to 2001. The 1996 version is only considered to represent a temporary situation that would not exist in 2001. Travel speeds on all segments of the Turnpike inside Route 128 either remain the same or improve as a result of the implementation of the proposed commuter rail service.

Table 5.1-2 Turnpike Peak Hour Traffic Volume Reductions

	1996	2001
Millbury and Grafton Stations Only (and Worcester)	193	N/A
All Stations	525	568

Notes:
1. *The above numbers represent peak hour vehicle trips diverted from each Turnpike segment inside Route 128 by the Worcester Commuter Rail Extension service.*
2. *There is no 2001 Build Millbury and Grafton Only (and Worcester)*

Analysis Results

The preceding analysis accounted for the reduction in VMT resulting from the Worcester Commuter Rail Extension. It did not account for the decrease in emissions associated with increased speeds for the remaining Turnpike users due to a reduction in overall traffic. To determine the emissions benefits associated with increased travel speeds, the "No Build" speed emission factors for the Turnpike segments were applied to the "Build" VMT to compute total emissions. These figures were then compared to the total emissions of the "Build" scenario. The net benefits are shown in Table 5.1-3. As indicated in the table, improved travel speeds result in reductions in CO and VOC emissions but a slight increase in NOx emissions. This is consistent with the findings of similar analyses of traffic flow improvements elsewhere. As calculated by EPA's Mobile5a model, VOC and CO emissions tend to decrease (up to a point) with increased speeds, while NOx emissions tend to increase. Comparison of speeds, level of service, and traffic volumes for each segment under "Build" and "No Build" alternatives per segment of the Turnpike with the corresponding emissions are provided in Appendix G.

The total effect of trip diversions, which consists of the combined benefits of emissions reductions associated with reduced VMT and emissions reductions associated with the improved speeds on the Turnpike are shown in Table 5.1-4.

Table 5.1-3 Impacts on Emissions of Reduced Peak Hour Traffic Volumes on the Massachusetts Turnpike (Kilograms/day)

	VOC (Kg.)	NO_x (Kg.)	CO (Kg.)
With Commuter Rail Extension and "No-Build" Emission Rates			
1996 Millbury and Grafton Only (and Worcester)	173	239	1,707
1996 All Stations	163	225	1,610
2001 All Stations	97	178	1,111
With Commuter Rail Extension			
1996 Millbury and Grafton Only (and Worcester)	161	244	1,558
1996 All Stations	148	235	1,429
2001 All Stations	81	186	817
Net Daily Benefit of Increased Speeds			
1996 Millbury and Grafton Only (and Worcester)	12	(5)	149
1996 All Stations	15	(10)	181
2001 All Stations	16	(8)	294

Note: The net benefit of NO_x results in a negative number due to the relationship of NO_x emissions and speed. At higher speeds, NO_x emissions increase.

Table 5.1-4 Total Reduction in Emissions from Diverted Auto Trips (Kilograms/day)

	VOC (Kg.)	NO_x (Kg.)	CO (Kg.)
1996 Millbury and Grafton Only (and Worcester)	78	91	811
1996 All Stations	138	183	1,395
2001 All Stations	85	150	1,012

VOC and NO_x emission rates are based on summer conditions. The CO emission rate is based on winter conditions.

Impacts of Commuter Rail Operations

This section quantifies the emissions associated with the operation of the commuter trains for 1996 and 2001. The locomotive emission factors are held constant for these two time

periods because data are not available which documents how locomotive emissions may change over time. In addition to the train emissions calculations, a bus alternative was developed to put the locomotive emission rates in perspective. Because it was assumed to be a hypothetical scenario, new ridership estimates were not generated for the bus alternative. Its purpose was to show the comparison between locomotive and bus engine emissions factors.

Comparisons are made for years 1996 and 2001. The EPA's emission model Mobile5a was used to generate factors for heavy duty diesel vehicles, based on the model assumptions given above. These results were used to represent bus emission rates, consistent with conventional practice.

Commuter Rail Analysis Assumptions

- The locomotive emission factors are based on the 16-645E3C engine, manufactured by EMD. The emission factors for the 16-645E3B provided by the *"Locomotive Emission Study,"* prepared for the California Air Resources Board by Booz, Allen and Hamilton, Inc. were adjusted to reflect the 16-645E3C engine based on data received from the MBTA.

- The locomotive emission factors, provided in grams per hour by notch, were proportioned to represent a typical operating profile. This profile is based on data contained in the above mentioned *"Locomotive Emission Study."*

- The locomotive operations included in the air quality analysis only account for the new service provided under the various alternatives. For example, existing service from Framingham to Boston which extends its route to include Worcester and the additional stations only contributes the incremental pollutants emitted between Framingham and Worcester, whereas entirely new trains added to the schedule account for additional emissions between Worcester and Boston.

- The locomotive emissions calculated are constant among all "Build" alternatives. The 1996 Build alternative with Millbury and Grafton Stations Only (and Worcester) built still operates the basic 10 train service, identical to the All Station alternatives. This is constant in all scenarios.

Bus Analysis Assumptions

- The bus alternative is assumed to generate the same level of ridership as the commuter rail extension, with service originating at each of the proposed commuter rail stations. Peak period service assumes buses departing from each station with express service to Boston.

- Off peak trips consist of buses serving combinations of stations grouped as follows: Ashland-Southborough-Westborough; and Grafton-Millbury-Worcester. The off peak ridership (assumed to be 6% of total ridership) is not sufficient enough to require a bus for each station. Therefore, this alternative assumes the buses would operate non-express service in the off peak based on the above geographically based groupings.

- The emission rates for the buses are based on the EPA's Mobile5a Heavy Duty Diesel Vehicle (HDDV) rates for 1996 and 2001, with all specific Massachusetts air quality programs as discussed earlier.

- The number of bus trips for each scenario are as follows:

  - 1996 Build with Grafton, Millbury, and Worcester Stations the bus service consists of 19 inbound and 19 outbound peak period bus trips and 6 inbound and 6 outbound for off peak service.

  - 1996/2001 Build with All Stations, the bus service consists of 57 inbound and 59 outbound peak period bus trips in 1996 and 59 inbound and 61 outbound in 2001. Off peak service consists of 12 inbound and 12 outbound in both 1996 and 2001.

- One dead head (empty) bus was assumed to exist for each station, both in the AM peak and PM peak.

- Bus mileage (VMT) was calculated based on the distances determined for the auto emission analysis with adjustments made for the off peak service to multiple stations.

Analysis Results

The analysis results reveal the increase in the emission of pollutants due to the operation of trains for the Worcester Commuter Rail Extension. As discussed in the assumptions section, one set of emission numbers was calculated to represent all alternatives. These results are shown in Table 5.1-5 along with the bus analysis results. Again, the bus alternative was included as a bench mark for comparison with the locomotive emissions. As the table shows, the locomotive emissions for VOC and CO are generally lower than buses. Locomotive NOx emissions are higher.

Table 5.1-5 Impacts of Locomotive and Bus Operations on Emissions (Kilograms/day)

	VOC (Kg.)	NO_x (Kg.)	CO (Kg.)
Locomotive Operations			
1996 Millbury and Grafton Only (and Worcester)	4	77	11
1996 All Stations	4	77	11
2001 All Stations	4	77	11
Bus Operations			
1996 Millbury and Grafton Only (and Worcester)	3	25	13
1996 All Stations	6	54	30
2001 All Stations	6	42	31

Note:
1. *VOC and NO_x emission rates are based on summer conditions. The CO emission rates are based on winter conditions.*
2. *As mentioned, the locomotive emission calculations remain constant for all scenarios.*

Summary of Regional Air Quality Impacts

The regional air quality analysis combines the results of the three individual analyses and shows that there is a calculated net reduction in VOC, NOx, and CO emissions due to operation of the Worcester Commuter Rail Extension. The net reductions are based on the cumulative impacts shown in three analyses presented above: Impacts of Auto Trip Diversion to Commuter Rail; Impacts of Auto Trip Diversion on Peak Hour Massachusetts Turnpike Operations; and Impacts of Commuter Rail Operations. The greatest reduction in emissions occurs under the 1996 Build All Station scenario as follows:

- Net reduction in VOC of 133 kilograms per day.
- Net reduction in NOx of 106 kilograms per day.
- Net reduction in CO of 1,384 kilograms per day.

Table 5.1-6 presents the summary of the three analyses as well as the regional calculated net air quality benefit.

Table 5.1-6 Regional Calculated Net Daily Benefit of Commuter Rail Operations (Kilograms/day)

	VOC (Kg.)	NO_x (Kg.)	CO (Kg.)
Impacts of Reduced Vehicle-Miles Traveled Resulting from Auto Trip Diversion			
1996 Millbury and Grafton Only (and Worcester)	66	96	662
1996 All Stations	122	193	1,214
2001 All Stations	69	158	718
Impacts of Reduced Traffic Volumes During Peak Hour Massachusetts Turnpike Operations			
1996 Millbury and Grafton Only (and Worcester)	12	(5)	149
1996 All Stations	15	(10)	181
2001 All Stations	16	(8)	294
Impacts of Locomotive Operations			
1996 Millbury and Grafton Only (and Worcester)	(4)	(77)	(11)
1996 All Stations	(4)	(77)	(11)
2001 All Stations	(4)	(77)	(11)
Total Net Daily Benefits			
1996 Millbury and Grafton Only (and Worcester)	74	14	800
1996 All Stations	133	106	1,384
2001 All Stations	81	73	1,001

Reductions in emissions result from the impacts of reduced VMT caused by auto trip diversion and the impacts of reduced traffic volumes on the Turnpike during peak hour operations caused by auto trip diversion. The locomotive emissions represent additional or new emissions caused by the operation of the commuter rail extension.

Table 5.1-6 presents the combined emission reductions of auto trip diversions and increased Turnpike speed, with total net reductions due to the commuter rail extension. Net CO emissions are greatly influenced by auto trip diversions and improved Turnpike operations, with only minor offsetting emissions due to train operations. The State Implementation Plan (SIP) for the attainment of National Ambient Air Quality Standards

targets CO emissions as "hot spots" on the microscale level and reductions in VOC emissions between now and the end of 1996. Table 5.1-6 reflects net reductions in both of these pollutants. After 1996, the SIP is expected to focus on the reductions in both VOC and NOx.

The combination of VOC and NOx by photochemical oxidation (in the presence of heat and sunlight) forms ozone (O_3). The oxidation process occurs over a period of time at a metropolitan or regional scale and is also a function of the transport of the pollutants over potentially long distances and long periods of time. The region is classified as "serious" non-attainment status for O_3 under the Clean Air Act Amendments of 1990.

The reactivity of VOC and NOx is a complex process which is being studied by the EPA and the Massachusetts DEP. The current baseline inventory reveals that VOCs and NOx exist in the atmosphere in approximately equal proportions, although the relationship between the two pollutants in the formation of ozone is difficult to quantify. The sum of the VOC and NOx emissions in Table 5.1-6 indicate that a total net reduction in both pollutants would occur as a result of the commuter rail extension.

5.2 Noise and Vibration

Train Operations

Although the railroad corridor between Framingham and Worcester has been actively carrying both freight and intercity rail traffic for many years, the proposed addition of commuter train operations may affect the noise and vibration environment along the right-of-way. These changes relate primarily to an increase in train frequency, consists and speeds. Both the methodology used to quantify these changes and the criteria used to assess their effects were described in detail in the November 1994 Draft EIR Appendix Volume 2, Section 3 (Noise and Vibration). A discussion of noise and vibration descriptors, and impact criteria are found in Appendix F of this FEIR.

Noise Impacts from Train Operations

The basic noise unit for community noise is the A-weighted Sound Level, expressed in decibels (dBA). The A-weighted sound level is a single-number measure of sound pressure with weighted frequency characteristics that correspond to the human ear's sensitivity to noise. For an intermittent noise event such as a train pass-by, various metrics or descriptors exist which apply to noise measurement methods, computations and impact assessment. Most useful are those based on the noise "dose" or total sound

energy during one or a number of events, which correlates well to people's reaction to noise. The noise descriptors that apply to rail transportation are defined in the Appendix.

The significance of noise impacts from train operations on the Worcester Commuter Rail Extension Project corridor was assessed based on the projected total noise increase relative to existing conditions at noise-sensitive locations abutting the right-of-way. Noise-sensitive land uses considered in this study include 1) residences and other buildings where people normally sleep; 2) institutional uses such as schools and churches, and 3) buildings and parklands where quiet is an important element in their intended purpose, such as outdoor concert pavilions. This increase is measured in terms of the change in the day-night sound level, or L_{dn}. The L_{dn} measure represents the total dose of noise energy at a given outdoor location over a 24-hour period in terms of the A-weighted sound level (dBA), with a 10 decibel penalty on noise occurring during the nighttime hours (10:00 P.M. to 7:00 A.M.). This descriptor is applicable to residences and other buildings where people normally sleep. Other noise-sensitive land uses are assessed for the hours of sensitivity using the hourly equivalent sound level L_{eq}.

To indicate representative values of L_{dn} for everyday noise, Figure 5.2-1 provides examples of typical noise environments and criteria. Except for extreme situations, L_{dn} is generally found to range between 55 dBA and 75 dBA in populated areas. As shown in the figure, this spans the range between an "ideal" and an "unacceptable" residential environment according to various federal agency criteria.

A standard theoretical model was used to predict existing and future noise levels, using reference noise source emission levels for the various equipment types obtained from measurements. Noise measurement data of MBTA commuter rail trains along the Framingham Line were used as the reference for future levels generated by commuter service along the project corridor. Similarly, measurements of existing Amtrak and Conrail trains were used for estimating the non-project components of the overall noise.

While the DEIR Appendix describes the noise model and its assumptions in detail, Figure 5.2-2 illustrates how the various noise sources behave as a function of train speed, at a fixed distance to each source. Plotted vertically is the source's maximum noise level during a train pass-by, while train speed is plotted horizontally. It is shown that the noise generated by the interaction of the wheels and rails (rail cars) has a strong speed-dependency, and the noise from these sources increases rapidly with train speed. In contrast, noise from diesel locomotives exhibit a very weak dependence on speed, and shows little variation. The combined result is that at very high speeds, wheel/rail sources dominate the wayside noise while at low speeds noise from the locomotive exhaust is predominant. Locomotive horn noise exhibits no speed dependence due to the on/off nature of the noise source.

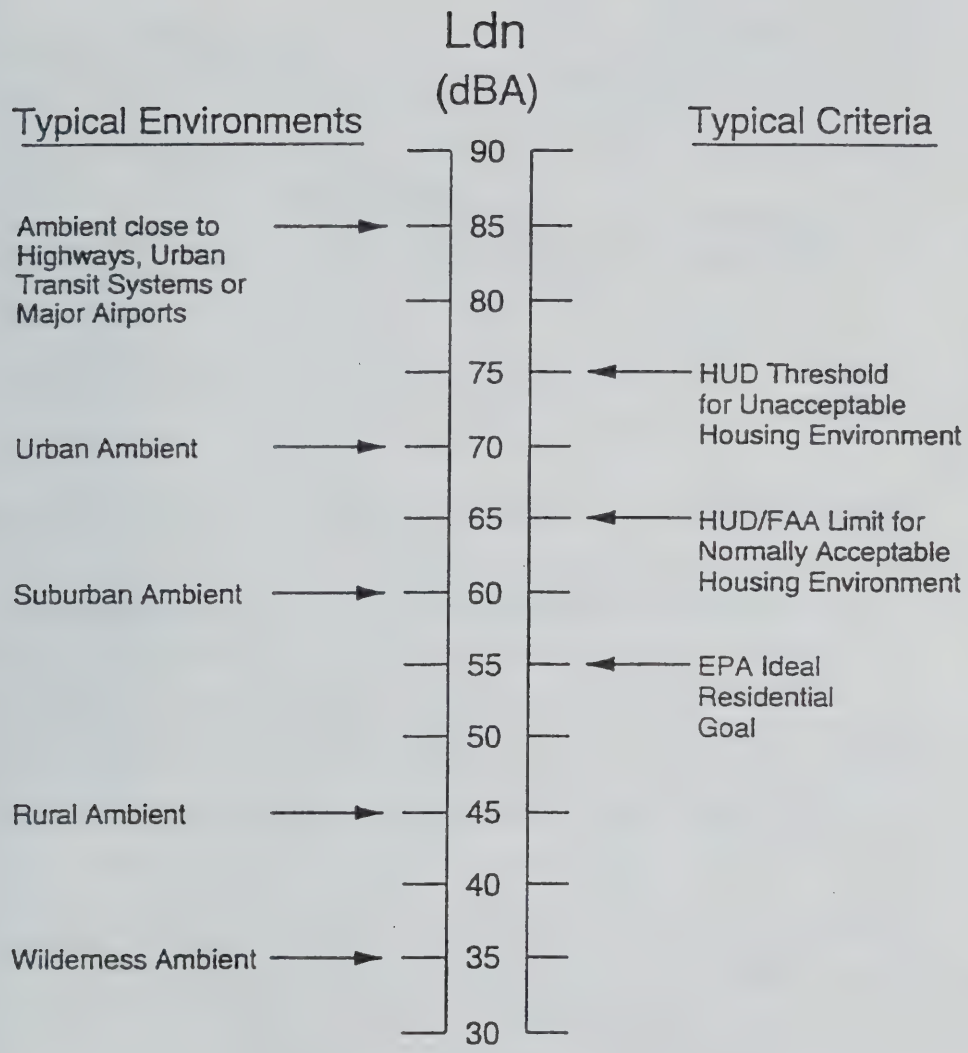


Figure 5.2-1 Typical L_{dn} Values and Criteria

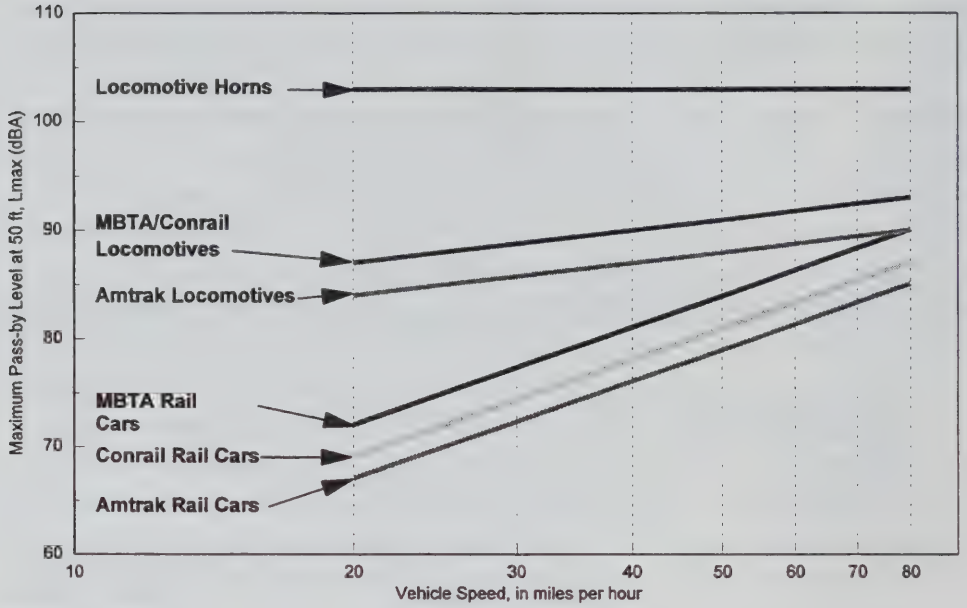


Figure 5.2-2 Dependence of Maximum Sound Levels on Vehicle Speed (at 50 ft)

Table 5.2-1 provides an overview of train noise impact along the project corridor, based on the results at representative measurement sites. Details of the measurement program are also provided in the DEIR Appendix, including site locations and results. The table lists the L_{dn} projected by the noise estimation model at each of the eight measurement locations for the existing, and basic commuter rail service conditions. It also indicates the predicted noise increase for the future case, along with site-specific impact criteria and assessment.

For purposes of impact assessment, this study uses the FTA severe impact criteria, as given in the Appendix. Under these criteria, mitigation must be considered when the increase in noise exceeds a limit above that for severe impact. These criteria are more stringent for areas with high ambient noise than for low noise areas by decreasing the allowable increase in noise in these areas. For example, a noise increase of 15 dBA is allowed if the existing L_{dn} is 42 dBA, whereas only a 3 dBA increase is allowed when the existing L_{dn} is 70 dBA.

Table 5.2-1 Train Noise Impact Assessment at Measurement Sites

Site	Milepost	Town	Dist. from Corridor CL (ft)	TOTAL EXISTING L_{dn} (dBA)		Limit for Increase (dBA)	BASIC MBTA SERVICE		
				Meas.	Pred.		$TotL_{dn}$	Increase (dBA)	Severe Impact?
1	44.3	Worc.	425	76	75	2	75	0	No
2	40.3	Worc.	50	65	68	3	70	2	No
3	39.3	Millbury	200	63	62	5	65	3	No
4	37.1	Grafton *	100	70	72	3	73	1	No
5	33.7	West-borough **	50	--	68	3	70	2	No
6	32.2	West-borough	100	62	65	4	68	3	No
7	28.1	South-borough	70	68	67	3	69	2	No
8	24.6	Ashland	90	71	72	3	73	1	No

* *Indicates measurement site located near grade crossing.*
** *Indicates short-term measurement site; L_{dn} not measured.*

Noise Impacts - All Stations

Table 5.2-2 provides a corridor-wide inventory of projected train noise impact. This table indicates the estimated number of noise-sensitive receptors, in terms of residential dwelling units, located within the noise impact zone for Basic Service for all five proposed new stations. All of these receptors were residential land uses since there were no noise-sensitive institutional land uses identified within the applicable distance from the right-of-way. The noise impact zone was determined by comparing noise projections with the project criteria along individual segments of the corridor, and by calculating the distances within which impact would occur. These train noise impact distances are given by corridor milepost segment in the DEIR Appendix. The numbers of residential buildings located within the impact zone were counted with the aid of land-use maps and aerial photographs of the project corridor.

The only area of concentrated noise impact is at a group of houses just east of Route 140 in Grafton where train speeds approach their upper limits. Other noise impacts identified along the right-of-way consist mainly of scattered residential land uses situated very close to the tracks.

An extension of an existing subdivision is under construction northerly of the proposed Millbury Station. Existing residences range from about 560 feet to 1,000 from the right-of-way, and should not be impacted by noise due to Basic Service. The most southern lot of this subdivision extends to within 80 feet of the track; any house built there has the potential to be impacted by noise. Since no residences in the subdivision are impacted by Basic Service, no noise mitigation is necessary.

In the table, the typical distance to limit of noise impact is 25 feet. The minimum railroad right-of-way width is 66 feet; thus for most segments of the corridor, there will be no noise impact outside of the right-of-way.

Table 5.2-2 Train Noise Impact Inventory for Basic Service To All Stations

SEGMENT ENDING	CITY/TOWN	MILEPOST		Est. Train Speed (mph)	BASIC SERVICE	
		FROM	TO		Distance to Noise Impact (ft)	No. of Residences within Impact Distance
Framingham Sta	Framingham	21.3	21.3	--	--	--
	Framingham	21.3	21.5	30	25	0
Fountain St	Framingham	21.5	21.9	30	25	0
Winter St	Framingham	21.9	22.4	40	25	0
Ashland Line	Framingham	22.4	22.8	50	25	0
TOTAL	**Framingham**	**21.3**	**22.8**			**0**
Fountain St	Ashland	22.8	23.7	50	25	0
Sudbury River	Ashland	23.7	23.8	50	25	0
Main/Cherry GX's	Ashland	23.8	24.7	30	25	0
ASHLAND STATION	Ashland	24.7	25.3	15	25	0
	Ashland	25.3	25.7	44	25	0
High St	Ashland	25.7	25.9	53	25	0
	Ashland	25.9	26.0	53	25	0
	Ashland	26.0	26.3	53	25	0
Southborough Line	Ashland	26.3	26.4	53	25	0
TOTAL	**Ashland**	**22.8**	**26.4**			**0**

Table 5.2-2 Train Noise Impact Inventory for Basic Service To All Stations

SEGMENT ENDING	CITY/TOWN	MILEPOST		Est. Train Speed (mph)	BASIC SERVICE	
		FROM	TO		Distance to Noise Impact (ft)	No. of Residences within Impact Distance
	Southborough	26.4	26.9	53	25	0
River St/Rt 85	Southborough	26.9	27.3	31	25	0
SOUTHBOROUGH STA	Southborough	27.3	27.4	15	25	0
	Southborough	27.4	27.5	20	25	0
	Southborough	27.5	27.6	60	25	0
Bridge St	Southborough	27.4	28.0	50	25	0
Westborough Line	Southborough	28.0	28.5	55	25	0
TOTAL	**Southborough**	**26.4**	**28.5**			**0**
Fruit St	Westborough	28.5	28.9	55	25	0
I-495	Westborough	28.9	29.5	55	25	0
	Westborough	29.5	29.8	60	25	0
Conrail Yard	Westborough	29.8	30.1	60	25	0
Rt 30	Westborough	30.1	32.0	60	25	0
Milk St/Rt 135	Westborough	32.0	32.7	60	25	1
	Westborough	32.7	33.0	60	25	0
	Westborough	33.0	33.2	60	25	0
Otis St	Westborough	33.2	33.4	60	25	0
	Westborough	33.4	33.5	50	25	0
	Westborough	33.5	33.7	30	25	0
WESTBOROUGH STA	Westborough	33.7	33.9	15	25	0
	Westborough	33.9	34.4	30	25	0
Arch St	Westborough	34.4	34.7	45	25	0
	Westborough	34.7	35.2	50	25	0
Grafton Line	Westborough	35.2	35.8	55	25	0
TOTAL	**Westborough**	**28.5**	**35.8**			**1**

Table 5.2-2 Train Noise Impact Inventory for Basic Service To All Stations

SEGMENT ENDING	CITY/TOWN	MILEPOST		Est. Train Speed (mph)	BASIC SERVICE	
		FROM	TO		Distance to Noise Impact (ft)	No. of Residences within Impact Distance
Tufts Univ	Grafton	35.8	36.2	52	25	0
Pine St	Grafton	36.2	36.4	40	25	0
GRAFTON STA	Grafton	36.4	36.5	15	25	0
	Grafton	36.5	36.9	40	25	0
Grafton GX	Grafton	36.9	37.2	50	25	0
	Grafton	37.2	37.5	60	25	0
Rt 140	Grafton	37.5	38.0	59	75	6
Millbury Line	Grafton	38.0	39.0	60	70	0
TOTAL	**Grafton**	**35.8**	**39.0**			**6**
	Millbury	39.0	39.4	45	25	0
	Millbury	39.4	39.5	30	25	0
MILLBURY STA	Millbury	39.5	39.6	15	25	0
TOTAL	**Millbury**	**39.0**	**39.6**			**0**
Route 20	Worcester	39.6	39.9	40	25	0
Sunderland Rd	Worcester	39.9	40.2	44	25	0
Lake Park/Coburn	Worcester	40.2	41.5	40	25	0
Hamilton St	Worcester	41.5	41.7	40	25	0
	Worcester	41.7	42.3	50	25	0
Eastview Rd	Worcester	42.3	42.4	40	25	0
(Eastview Apts)	Worcester	42.4	42.6	40	25	0
Plantation St	Worcester	42.6	42.8	40	25	0
Draper St	Worcester	42.8	43.2	40	25	0
Putnam St	Worcester	43.2	43.9	40	25	0
	Worcester	43.9	44.1	25	25	0
	Worcester	44.1	44.2	25	25	0
Worcester Sta	Worcester	44.2	44.3	15	25	0
TOTAL	**Worcester**	**39.6**	**44.3**			**0**
TOTAL FOR CORRIDOR						**7**

Noise Impacts - Grafton and Millbury Only

Under the initial Basic Service operations, only the Grafton and Millbury stations are open. MBTA trains will not stop in Westborough, Southborough, and Ashland allowing the trains to operate at higher speeds though these towns. Since the noise generated by the train is speed dependent, the impact distances will increase in some areas. There are no additional residences impacted, therefore no additional mitigation measures are necessary to deal with the temporary effects.

Grade Crossings

A primary cause of noise impact is the sounding of train horns near grade crossings, which has a significant contribution to the total noise exposure. For example, the noise impact assessment for the town of Ashland shows that two crossings within one-half mile of each other in a largely residential neighborhood contribute to high noise levels, both existing and future. There is a total of 189 residences impacted by horn noise from existing AMTRAK and Conrail trains at the grade crossings. The addition of MBTA trains will increase the number of crossings per day, but the number of homes impacted will remain unchanged (see Table 5.2-3).

Table 5.2-3 Summary of Noise Impacts at Grade Crossings

City/Town	Milepost		Number of impacted residences - existing service	Number of impacted residences - MBTA Basic service
Ashland	23.8	24.7	12	12
Grafton	36.9	37.2	6	6
Totals			18	18

Train Noise Mitigation

As indicated in Table 5.2-2, the train noise evaluation projects a total of 7 residential units to be within the zone of severe impact for the Proposed Basic Service to all stations. To address potential impact mitigation, source, path and receiver noise control measures have been considered as described below.

Source Noise Control

Train noise control at the source can involve equipment and track-related measures as well as operational modifications. Although with diesel-locomotive trains the highest noise levels are not necessarily caused by the wheel/rail interactions, considerable noise

emanates from the wheels on the cars. One effective mitigation measure will be to ensure a good wheel and rail maintenance program. Such a program includes the installation of equipment to detect vehicle wheel flats on a continuing basis, along with periodic wheel truing and rail grinding.

In the case of noise impacts identified as a result of horn noise near the Ashland and Grafton grade crossings, a future mitigation measure would be the installation of stationary horn devices. While still in the experimental stages, this type of system could involve the installation of horns at fixed locations at the grade crossing, rather than on the trains themselves. The horns would be part of a standard signalized grade crossing. The warning sounds would be aimed directly down the cross-streets in the immediate vicinity of the crossing where they are needed most, and not sideways into the community as with conventional locomotive-mounted horns. Grade crossing horns will not be ready for service on the Worcester commuter rail until the technology is proven.

Path Noise Control

The installation of wayside noise barriers, designed to block the direct sound path between the trains and the noise-sensitive sites along the corridor, is the most common and is likely to be the most effective measure to mitigate train noise impact. Such barriers would need to be heavy enough, high enough and long enough to provide the necessary shielding. A noise barrier would ideally provide 10 to 15 dBA of noise reduction for the maximum level generated by a single train passage. Assuming that train noise is the dominant source of the noise for a protected location, this translates to about 5 to 10 dBA reduction in the L_{dn}.

A rough estimate of the extent of barrier needed to mitigate train noise impact has been made based on the results of the impact inventory. The estimate assumes that at least 200 feet of barrier length would be required to shield each isolated residence; in more densely populated areas, the barrier length per residence could be less.

Mitigation cost estimates can be made based on a 16-ft high noise barrier costing $20 per square foot. The minimum barrier height for diesel-hauled trains is significantly higher than that of electric or rapid transit trains because the barrier must be high enough to shield the predominant noise source, the locomotive exhaust, which is positioned 10 to 12 ft above top-of-rail.

The barrier locations, lengths and heights estimated in the study are at this stage preliminary. Detailed barrier designs will be developed during the final design stage of the project, and the barriers will be constructed only if they are found to be reasonable, feasible and visually acceptable to the affected property owners. Some of the factors that will need to be addressed at that point are the structural, aesthetic and acoustical

feasibility of the barriers, as well as their cost effectiveness with respect to their acoustical benefits.

The MBTA has used the cost/benefit criterion for all proposed sound barriers for determination of economical reasonableness. This criterion prescribes an upper limit of $2,400 per dB/dwelling applied to the first floor of residences only. MBTA policy provides for the expenditure of up to 2% of the project construction cost for noise and vibration impact mitigation. Consideration of the cost effectiveness of any noise mitigation measures must be weighed against the actual relief provided.

A preliminary analysis of the area east of Route 140 in Grafton suggests that construction of a 500-foot barrier along the south side of the track would be feasible. The barrier would provide a significant noise reduction for some of the homes on Westborough Rd. Present L_{dn} with Conrail and Amtrak trains is about 70 dBA fifty feet away from the tracks. Basic service is expected to raise this level to about 75 dBA. An 8-foot high barrier would lower the L_{dn} to 65 dBA, at a cost of approximately $80,000, which falls well within the MBTA's price criterion (See Table 5.2-4 and Figure 5.2-3). The track side of the barrier would be treated with sound absorbing material to prevent reflected sound from impacting residences on the north side of the railroad.

Table 5.2-4 Summary of Potential Train Noise Mitigation

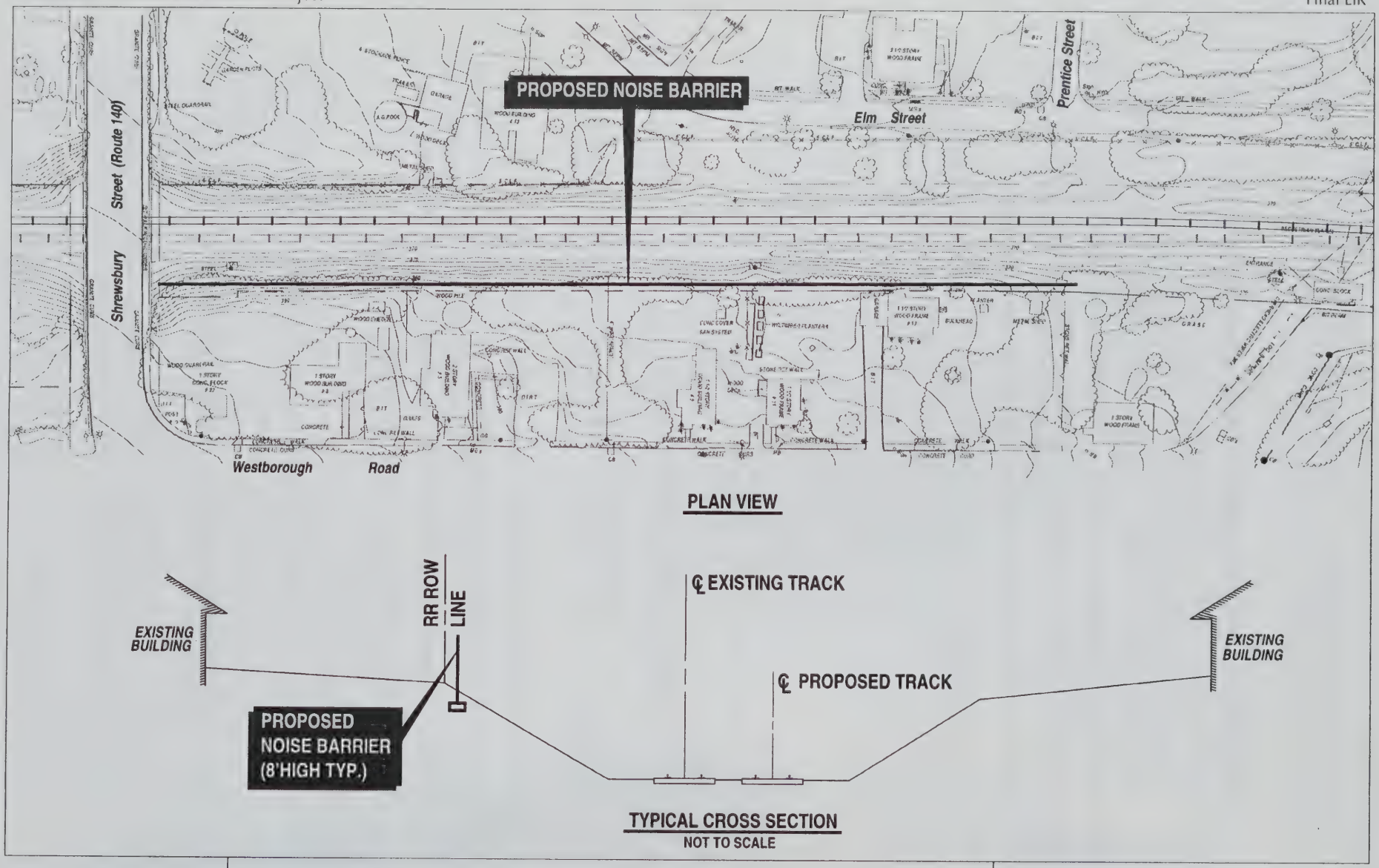
City/Town	Milepost		Number of Mitigated Residences	Noise Barrier Length (ft)
	To	From		
GRAFTON	37.9	38.0	5	500

For the two isolated residences, (one in Westborough, one Grafton) the cost of a 200-foot long barrier (the minimum length to provide a 10 dBA reduction of individual train noise) would be approximately $64,000 per installation. In each instance, the barrier does not meet the $2,400 per dB/dwelling criterion for economic reasonableness.

Receiver Noise Control

Noise control at the receiver provides an alternative approach where source or path treatments are not feasible. Potential mitigation measures include property acquisition or the application of sound-insulation treatment to noise-sensitive buildings within the impact zone. One disadvantage of sound insulation treatment is that it has no effect on noise in exterior areas.

Substantial improvements in building sound insulation (on the order of 5 to 10 dBA) can usually be achieved by adding an extra layer of glazing to the windows, by improving



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 100'
0 100

PROPOSED NOISE BARRIER TOWN OF GRAFTON

FIGURE 5.2-3

the weather stripping around doors and windows, by sealing any holes in exterior surfaces that act as sound leaks, and by providing forced ventilation and air conditioning so that windows do not need to be opened.

Vibration Impacts from Train Operations

Criteria used in assessing vibration impact were discussed in Section 4.3 of the FEIR, Environmental Impacts - Railroad Right-of-Way and are repeated in Appendix F of this FEIR. What follows is a revised analysis of the vibration impact for the MBTA Basic Service scenario, with maximum train speeds kept at 60 mph for MBTA and Amtrak trains, and 40 mph for Conrail trains. [Previous analyses were based on MBTA train speeds of 70 and freight speeds of 50.]

Vibration Impacts -Build All Stations

The Basic Service schedule has stops at stations in Ashland, Westborough, Southborough, Grafton and Millbury. Table 5.2-5 gives a revised inventory of vibration impacts along the service corridor, along with estimated trains speeds and vibration impact distances. Speeds along the corridor will not exceed 60 miles per hour. Maps locating affected residences are in Appendix F of this FEIR.

Table 5.2-5 Corridor-wide Train Vibration Impact Inventory for Basic Service To All Stations

SEGMENT DESCRIPTION	CITY/TOWN	MILEPOST		Train Speed (mph)	Distance to Vibration Impact (ft)	# Residences in Impact Zone
		From	To			
Fountain St	Framingham	21.5	21.9	30	23	0
Winter St	Framingham	21.9	22.4	40	44	0
Ashland Line	Framingham	22.4	22.8	50	61	3
TOTAL	**Framingham**	**21.5**	**22.8**		--	**3**
Fountain St	Ashland	22.8	23.7	50	61	0
Sudbury River	Ashland	23.7	23.8	50	61	0
Main/Cherry GXs	Ashland	23.8	24.7	30	23	0
Ashland STA	Ashland	24.7	25.3	15	1	0
	Ashland	25.3	25.7	44	51	0
High St.	Ashland	25.7	25.9	60	78	0
	Ashland	25.9	26.0	53	66	0
	Ashland	26.0	26.3	53	66	0
Southborough Line	Ashland	26.3	26.4	53	66	0

Table 5.2-5 Corridor-wide Train Vibration Impact Inventory for Basic Service To All Stations

SEGMENT DESCRIPTION	CITY/TOWN	MILEPOST		Train Speed (mph)	Distance to Vibration Impact (ft)	# Residences in Impact Zone
		From	To			
TOTAL	**Ashland**	**22.8**	**26.4**		**--**	**0**
	Southborough	26.4	26.9	53	66	0
River St/Rt 85	Southborough	26.9	27.3	31	25	0
Southborough STA	Southborough	27.3	27.4	15	1	0
	Southborough	27.4	27.5	20	1	0
	Southborough	27.5	27.6	60	78	0
Bridge St	Southborough	27.6	28.0	60	78	2
Westborough Line	Southborough	28.0	28.5	55	70	2
TOTAL	**Southborough**	**26.4**	**28.5**		**--**	**4**
Fruit St	Westborough	28.5	28.9	50	61	0
I-495	Westborough	28.9	29.5	55	70	0
Conrail Yard	Westborough	29.5	30.1	60	78	0
Rt 30	Westborough	30.1	32.0	60	78	0
Milk St/Rt 135	Westborough	32.0	32.7	60	78	3
	Westborough	32.7	33.0	60	78	0
Maynard St br	Westborough	33.0	33.2	60	78	1
Otis St	Westborough	33.2	33.4	60	78	0
	Westborough	33.4	33.5	50	61	0
	Westborough	33.5	33.6	30	23	0
Westborough Sta	Westborough	33.6	33.9	15	1	0
Arch St	Westborough	33.9	34.7	45	53	0
	Westborough	34.7	35.2	50	61	0
Grafton Line	Westborough	35.2	35.8	55	70	0
TOTAL	**Westborough**	**28.5**	**35.8**		**--**	**4**
Tufts Univ	Grafton	35.8	36.2	52	65	0
Pine St	Grafton	36.2	36.4	40	44	0
Grafton Sta	Grafton	36.4	36.5	15	1	0
	Grafton	36.5	36.9	40	44	0

Table 5.2-5 Corridor-wide Train Vibration Impact Inventory for Basic Service To All Stations

SEGMENT DESCRIPTION	CITY/TOWN	MILEPOST		Train Speed (mph)	Distance to Vibration Impact (ft)	# Residences in Impact Zone
		From	To			
Grafton GX	Grafton	36.9	37.2	50	23	0
	Grafton	37.2	37.5	60	31	0
Rt 140	Grafton	37.5	38.0	59	30	1
Millbury Line	Grafton	38.0	39.0	60	31	0
TOTAL	**Grafton**	**35.8**	**39.0**		--	**1**
	Millbury	39.0	39.4	45	53	0
	Millbury	39.4	39.5	30	23	0
Millbury Sta	Millbury	39.5	39.6	15	1	0
TOTAL	**Millbury**	**39.0**	**39.6**		--	**0**
Rt 20	Worcester	39.6	39.9	30	23	0
Sunderland Rd.	Worcester	39.9	40.2	35	34	0
Lake Park/Coburn	Worcester	40.2	41.5	50	61	1
Hamilton St	Worcester	41.5	41.7	40	44	0
	Worcester	41.7	42.3	40	44	0
Eastview Rd.	Worcester	42.3	42.4	40	44	0
(Eastview Apts)	Worcester	42.4	42.6	40	44	0
Plantation St	Worcester	42.6	42.8	40	44	0
Draper St	Worcester	42.8	43.2	40	44	2
Putnam St	Worcester	43.2	43.9	40	44	0
	Worcester	43.9	44.1	25	1	0
	Worcester	44.1	44.2	25	1	0
Worcester Sta	Worcester	44.2	44.3	15	1	0
TOTAL	**Worcester**	**39.6**	**44.3**		--	**3**
CORRIDOR TOTAL						**15**

As reported in the DEIR all of the impacts identified in Table 5.2-5 are as a result of absolute impact incurred by MBTA commuter trains. It should be noted that all of the significant vibration impacts reflect annoyance or activity interference effects associated with indoor vibration and not building or structural damage. *In no cases do the projected train vibration levels exceed the vibration damage criteria along the corridor.*

Most of the vibration impacts occur within close distances of the right-of-way. Over the entire corridor no vibration impact will occur beyond about 100 ft of the nearest track centerline. The largest number of impacts are in Ashland, where the right-of-way passes through some residential areas with residences as close as 50 ft. In general, the vibration impacts occur in areas where commuter trains will be traveling at or close to their maximum speed of 60 mph.

Vibration Impacts - Build Millbury and Grafton Only

Because initially there will be no stops in Westborough, Southborough and Ashland under Basic Service, trains will operate at higher speeds through these towns, which will increase the distance of vibration impacts in some areas.

The only additional impact occurs at an 8-unit multifamily dwelling near the Cherry St. grade crossing in Ashland. Vibration during the initial Basic Service will be about 83 dBV at the building. With service to all stations, train speeds near Cherry St. will fall to 30 mph or less, bringing the vibration level at the building down to 77 dBV.

Train Vibration Mitigation

The train vibration evaluation projects a total of 15 residential vibration impacts for the proposed Basic Service to all stations, and 23 residential units for Basic Service to Grafton and Millbury only. The analysis also indicates that the primary areas of impact are expected to be where train speeds approach their upper limits. The vibration impact analysis was conducted assuming baseline conditions of continuously welded rail (CWR) in good condition on wood tie-and-ballast track. As for train noise, source, path and receiver vibration impact mitigation measures have been considered as described below.

Source Vibration Control:

Train vibration control at the source can involve equipment and track-related measures as well as operational modifications. Since the source of ground-borne vibration is the wheel/rail interaction, equipment and track-related measures are essentially limited to ensuring good maintenance practices such as rail grinding and wheel truing on a regular basis. Although maintenance alone cannot be relied upon to provide the required vibration mitigation, the construction of new track between Westborough and Worcester, as well as the overhaul of the existing trackbed will undoubtedly result in improved track condition from the present state. This, together with continued maintenance of both track and rolling stock, will result in lower vibration levels than those reported in this document.

While another vibration mitigation measure at the source would be a reduction in train speed, such operational modifications do not meet the objectives of the project.

Path Vibration Control:

Potential path vibration control treatments include (1) ballast mats, (2) floating slabs, and (3) trenches or underground barriers. These measures are discussed below.

- **Ballast Mats.** Ballast mats typically consist of a 2 to 3 inch-thick elastomer mat placed under the normal track ballast on a rigid, well-packed subgrade. Most ballast mat installations are supported on concrete foundations in subway tunnels or on concrete railroad bridges. Although there are some examples of ballast mats being installed for at-grade track, there is limited data on the effectiveness of at-grade installation. In addition, ballast mats are only effective at reducing vibration at frequencies of about 40 Hz and above. Recent measurements of MBTA commuter train vibration indicate that the typical ground vibration spectrum at locations calling for vibration mitigation contains a significant amount of energy below 40 Hz, which is much more difficult to control. Figure 5.2-4, average vibration spectra normalized to a distance of 50 ft from the track and a train speed of 60 mph are shown for the four vibration measurement sites in the project corridor.

  As seen in Figure 5.2-4, the vibration spectra measured at Sites 3 and 4 in Grafton have a noticeable absence of energy at low frequencies below about 31.5 Hz. This is the primary source of the dramatically lower overall levels measured at these sites. However, the spectra measured at Site 1 (Ashland) and Site 2 (Westborough) show significant differences in frequency content and magnitude. The Site 1 spectrum contains most of its energy centered at about 20 Hz, with a rapid falling-off of energy beyond 40 Hz. Site 2 also exhibits this low-frequency content down to 8 Hz, but also contains energy up to 63 Hz, resulting in slightly higher overall levels. At Sites 1 and 2, which are assumed to be typical of most of the project corridor, ballast mats would be considered largely ineffective and therefore infeasible.

  Another disadvantage of ballast mats is that they tend to be expensive, particularly for retrofit installations to existing track. Based on measurement data from existing installations, the estimated overall vibration reduction from commuter train passer-bys for most of the Framingham-Worcester project corridor would only be 2 to 4 dB. Given the high cost and small benefit achieved, ballast mats would not be considered cost-effective.

- **Floating Slabs.** Floating slabs consist of 1-ft thick or thicker concrete slabs supported by resilient pads on a concrete foundation. The tracks are mounted on top of the floating slabs. Most successful floating slab installations are in subways. To use them

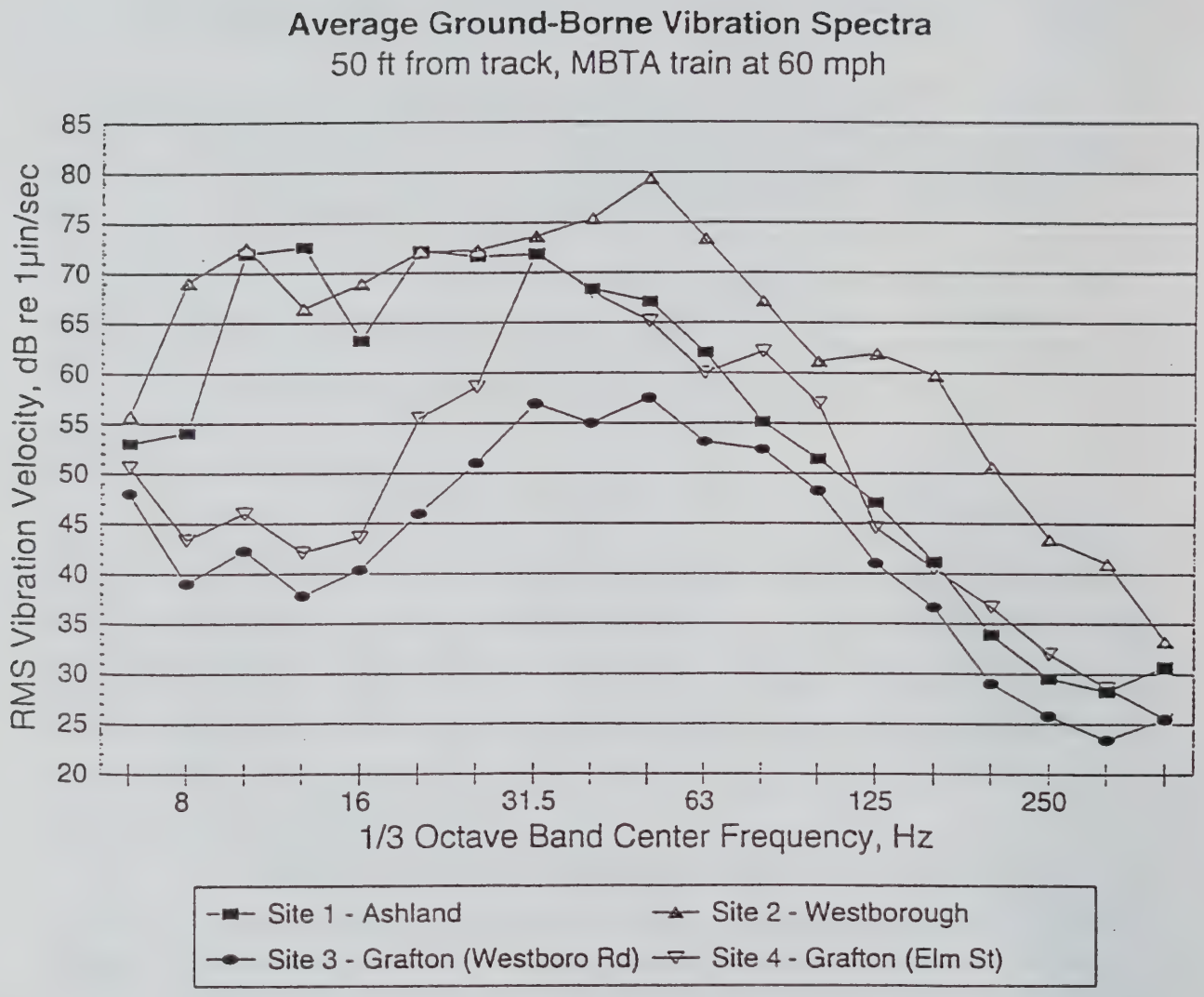


Figure 5.2-4 Ground Vibration Spectra from Commuter Train Pass-bys

with at-grade track, a concrete foundation must first be constructed for the slab to work against.

Construction of a floating slab track bed is significantly more expensive than tie and ballast at-grade track construction, even with ballast mats. Therefore, floating slabs are unlikely to be cost effective for this project.

- **Trenches or Underground Barriers.** Although rarely used, a deep trench, 30 to 80 ft deep, along one or both sides of the tracks can be an effective barrier to ground-borne vibration. The trench can be either open or filled with a material such as closed-cell foam or concrete. However, this is not likely to be a viable option for this project corridor. A deep trench test performed in Toronto, Canada produced only marginal results in terms of vibration attenuation.

Floating slabs and trenches are discussed here only to offer an idea of what alternative options are available for vibration control and should not be considered practical, "everyday" solutions. Floating slabs for at-grade track have rarely been implemented in this country; although two examples exist in the San Francisco area. One is on the Muni light rail line in downtown San Francisco, in which a short portion of embedded track was built using a floating slab and subsequent tests showed substantial attenuation of vibrations. Another application is for a new BART line, in an area found to have particularly efficient ground vibration propagation conditions, and an at-grade floating slab was judged to be the only method of effective mitigation. It is usually possible to control vibration with less expensive measures, such as ballast mats, if they are determined to be effective.

Receiver Vibration Control:

Practical vibration mitigation measures at the receiver are generally limited to property acquisition or the purchase of vibration easements. In cases where the cost of reducing ground-borne vibration levels to acceptable limits exceeds the value of the affected property, such measures may provide the most cost-effective means for train vibration impact mitigation.

Of the above measures, equipment maintenance and ballast mats are probably the most proven and practical means of providing mitigation from vibration impact. However, it is highly unlikely that ballast mats will be effective in controlling the low-frequency dominated vibration generated by the MBTA commuter rail trains. In addition, this project would require the installation of ballast mats under several miles of already existing track, requiring an extensive refit. Since the end result would be a reduction of

only a few decibels, ballast mats are not a cost-effective option for this project, and will not be used.

The only practical option for minimizing vibration impact to the community, therefore, is through a regular maintenance program of the wheels and trackbed. This will entail regular inspection and continued upkeep of the wheels and trackbed in good condition. However, even with such practices some residual vibration impact due to this project may be unavoidable once Basic Service operations are underway. While the vibration due to introduction of Basic Service will be noticeable at the Cherry St. residences, the increase in vibration is only temporary and will fall to acceptable levels under Basic Service to all stations. Therefore, it is not cost effective to consider mitigation for these residences.

5.3 Railroad At-Grade Crossings/Traffic

There are five (5) roadway grade crossings of the railroad between Worcester and Framingham. The crossings are located as follows:

- Grafton, Parmenter Crossing
- Ashland, Main Street and Cherry Street
- Framingham, Concord Street (Route 126) and Bishop Street

Scheduled train operations between Worcester and Framingham include 10 Conrail freights, 2 Amtrak intercity passenger trains and 6 MBTA commuter rail trains. Although schedules are subject to change, and unscheduled freight runs are likely, at least 18 daily trains pass through Grafton and Ashland. In Framingham, the daily trains are more numerous due to the Framingham-Boston commuter operations plus more unscheduled Conrail freights maneuvering in and out of the Framingham yard area. The Framingham train crossings and associated gate closings are addressed in Section 8.0 of this document.

MBTA Basic Service commuter trains will total 10 round trips as compared to the present Interim Service 3 round trips per day. Thus, 14 additional trains will increase the present train runs through Grafton and Ashland from 18 daily to 32 daily.

Parmenter Crossing in Grafton is located about ¾ miles west of Pine Street and runs about 150 feet north of Route 30 (Westborough Road) to the tracks (see Figure 3.0-1,

Panel 4 of 9). The road provides access to one residential property north of the tracks and is the only means of access/egress. The tracks are elevated compared to the surrounding lands and protected by a system of warning lights and bells. Traffic is minimal, likely to be only several vehicles daily. The addition of Basic Service commuter trains will not result in any significant adverse effect on traffic.

In Ashland, grade crossings at Main Street and Cherry Street are protected by gates, warning lights and bells (see Figure 3.0-1, Panel 8 of 9). Located in and near, respectively, the downtown section of Ashland, these crossings are used heavily, particularly the Main Street crossing. Town officials have expressed concerns regarding the safety aspects of the grade crossings, not only due to former operational problems with the gates and signals, but due to the general geometric and operational characteristics of the adjacent intersections. The Conrail owned and maintained gate system has been repaired and upgraded and is now considered to in good operating condition.

Evaluation of significant improvements to the roadways has not resulted in any viable solution to present or future traffic concerns. Basic considerations included a grade separation of the railroad/roadway grade crossing at Main Street (which would also necessitate a grade separation at Cherry Street, which is located only about 600 feet west of Main Street) and/or the addition of more travel lanes to improve the flow of traffic. A grade separation would have to be accomplished completely by a lowering of the tracks since elevating the roadway is not practical. Lowering the tracks, which would require depressing the tracks by at least 23 feet in downtown Ashland, would result in a project length of about 2 miles with literally miles of retaining walls and a prohibitive price tag. Maintaining railroad operations within the right-of-way during the track lowering construction activities would either be another prohibitive cost or an impossibility.

Roadway improvements, specifically the addition of travel and turning lanes, would require land takings and the removal of numerous buildings in downtown Ashland. This option, although quite likely a workable solution in terms of adequately reducing traffic delays, is clearly unacceptable politically and practically.

In Ashland, the analysis of signalized intersections presented in the November 1994 DEIR included intersection approach capacities that were decreased for most approaches for the intersections of Main Street with Front Street and Main Street with Summer Street/Homer Avenue to account for the effects of the at-grade railroad crossing adjacent to these intersections. Although only 3 or 4 of the 20 commuter trains are during morning or afternoon peak hour traffic conditions, the periodic gate closings effectively reduce intersection capacity proportional to the duration of the closing. The gate closings, which

vary in duration depending on train speed, are for approximately one minute. As presented in the DEIR, intersection level of service (LOS) for the Build vs. the No-Build Scenario for the Basic Service train schedule in the A.M. peak hour and peak generator hour improves somewhat for the Main/Front, Main/Union and Union/Summer intersections. The improvement in LOS is obtained by optimizing signal timings. The Main/Summer intersection shows a slight reduction in the peak generator hour. For the P.M. peak generator hour, the Main/Union intersection is predicted to have a degradation in LOS.

Upon completion of a commuter rail station in Ashland, many commuters will shift their travel mode from automobiles to commuter trains. Approximately the same number of vehicle trips will be made in the study area, but the trips to the rail station, with parking both north and south of the tracks, will result in fewer vehicles passing through the Main Street grade crossing. The ratio of commuter parking spaces is proposed to conform to the 70% of projected riders from south of the tracks and the 30% from north of the tracks. The vehicles which currently bypass the proposed station parking and continue through downtown Ashland, either from the north or the south, were not deducted from future traffic volumes. This situation resulted in a "worst case" traffic analysis.

The gate closings have been factored into the traffic analysis. But, as cited above, reduced traffic volumes due to the operation of an Ashland commuter station have not been deducted. Following the selection of the Ashland Station location, including the number of parking spaces north and south of the tracks, traffic at key intersections, including the grade crossing at Main Street, will be monitored. At that time, proper mitigation measures can be evaluated and discussed with appropriate Town officials. The monitoring, analyses, and proposed mitigation will be fully explored and presented in the third Final EIR covering the Westborough, Southborough, and Ashland Stations.

5.4 Archaeology and Historical

Overview

In this second FEIR it was hoped to bring to closure the following historic and archaeological issues:

- results of the architectural survey along the length of the right-of-way;

- the archaeological investigation in certain sections of right-of-way designated for fencing; and
- archaeological investigations of the proposed station sites in Millbury and Grafton.

Due to the unusually cold weather and record snowfall this winter, the architectural survey along the right-of-way and archaeological investigations of proposed fencing locations and of the Millbury Station site could not be completed in time for this filing. However, because substantial progress nonetheless has been made, this FEIR describes historic and archaeological impacts to the extent that they are known. Further, it includes an agreement [see Memorandum of Agreement (MOA) in Appendix H] between the MBTA and MHC which identifies commitments from the MBTA to complete the survey work as well as mitigation contingencies which are acceptable to both agencies. Thus, the MOA, which is subject to revision based on comment on this FEIR, will enable the MBTA to meet its obligations under M.G.L. Chapter 30, Section 61 with regard to outstanding right-of-way and Millbury Station historic and archaeological issues.

The potential effects on historic and archaeological resources are presented in this section to update and expand upon the presentation made for the railroad right-of-way in Section 7.8 (Cultural Resources) of the November 1994 DEIR and in Section 4.8 (Cultural Resources) of the July 1995 FEIR. Site specific historic and archaeological impacts for the proposed Millbury and Grafton commuter rail stations are discussed in Section 6.0 and Section 7.0 of this FEIR, respectively.

Historic Properties/Sites

An architectural survey was conducted along the railroad right-in-way. The survey located properties with potential historic value; those properties potentially eligible for inclusion on the National Register of Historic Places; and, existing National Register properties. To date, properties included in the survey have been grouped according to their proximity to the right-of-way and to proposed station locations. In addition, a detailed examination of these properties is underway and nearing completion. MHC staff were apprised of the status of this effort in a meeting held on February 2, 1996.

Even without the detailed description of all the properties, it is known that the project will have minimal impact on historic resources. A summary of survey properties potentially impacted are included in Appendix H.

Based in part on an overlay of the noise and vibration analyses conduced earlier, it appears that, of the total 88 properties examined in the survey, only one property listed

on the National Register of Historical Places will be affected. The proposed station site in Grafton, described in Section 7.0, is located within the Grafton State Hospital National Register District. An additional ten properties that will be visually impacted from the project appear to be eligible for listing, of which, eight are eligible only in a district, and one is likely to experience vibration impact. Another property which appears to be eligible for listing as a boundary increase would also be impacted by vibration and visually.

The Route 85 Bridge in Southborough warrants discussion. As part of the project, the existing bridge will be demolished and a replacement bridge will be constructed. This existing structure is one that appears to be eligible for listing in a district, but is not currently listed on either the State or National Registers. In the MOA, the MBTA has offered the MHC an opportunity for plan review of the replacement bridge prior to commencement of construction. In addition, the MBTA will perform an analysis of alternatives to demolition and will adequately document the bridge prior to demolition.

Archaeological

An archaeological investigation of limited areas within the right-of-way where fencing is likely to be needed was performed recently. Soil probes revealed that all proposed fencing locations had been filled or otherwise disturbed. A recommendation for no further archaeological testing has been approved by the MHC.

5.5 Mitigation Measures

Introduction of Basic Service has been determined to result in noise impacts to seven residential properties along the rail corridor. Five of the affected properties are located adjacent to each other on Westborough Street in Grafton. Analysis has shown that construction of a noise barrier 500 feet in length in this location can provide significant reduction in noise impact from Basic Service train operations. The barrier meets the MBTA cost-effectiveness criterion. Installation of the barrier will be subject to abutter preference.

Basic Service to all stations would result in vibration impact to 15 residences. Service to Millbury and Grafton only will temporarily increase the number of affected properties to 23. As described in the FEIR for Layover Facility and Railroad Right-of-Way, there is no effective mitigation technology available.

The process of archaeological evaluation of the project is not yet complete. Measures to address mitigation, if required, are included in the MOA between the Massachusetts Historical Commission and the MBTA. (See Appendix H).

SECTION 6.0 ENVIRONMENTAL IMPACTS—MILLBURY STATION

Introduction

This Section of the Final EIR evaluates potential environmental impacts of the Route 20 alternative for the proposed Millbury Station. The Draft EIR presented two alternative station sites in Millbury, both proposing parking for 300 vehicles. The location of the station platforms is very similar for both alternatives. The major difference between the alternatives is that one provided parking south of the tracks accessed by a new roadway connecting to Route 122 opposite the Turnpike Exit 11 in Millbury, while the other alternative provides parking on the north side of the tracks accessed by a new road connecting to Route 20 in Worcester.

With input from the Citizens Advisory Committee, the Millbury Commuter Rail Advisory Committee, and consideration of comments received on the Draft EIR, the MBTA has designated the Route 20 access alternative as the proposed Millbury Station site.

Recently, the MBTA has received a number of comments and other expressions of concern from the City of Worcester and residents of the Flint Pond subdivision located to the north of the proposed station site. As further detailed in the remainder of this section, there does not appear to be any substantial negative effect on this neighborhood. The station access road, which will carry relatively light traffic volumes, will slightly impinge upon one undeveloped lot of the subdivision. The proposed station parking area will be 150± feet from the nearest developed parcel, but 340± feet from the residence on that parcel. Much of the traffic bound for the new station is likely to be already on Route 20 on its way to the Massachusetts Turnpike. The MBTA proposes visual screening with vegetation and careful control of lighting to limit any negative effects. Even so, the MBTA is working with the City of Worcester and the neighbors to explore ways further of limiting any perceived effects. Should these discussions bear fruit, they will be reported to the Secretary in the Final Section 61 Finding for the Millbury Station.

The proposed project plans to construct five intermediate stations between Worcester and Framingham. As an interim condition, Millbury and Grafton stations will be constructed

in 1996 pending resolution of issues relating to implementation of the other three stations in Westborough, Southborough, and Ashland.

If all stations were to be in service in 1996, Millbury is projected to attract 149 patrons per day. Under the five station scenario, ridership would increase to 162 patrons in 2001. During the interim, when stations in Westborough, Southborough, and Ashland are not yet in service, Millbury ridership is estimated to be 161 people a day in 1996. (A full discussion of ridership projections and analysis methodology is presented in Section 4.3.)

6.1 Millbury Station Elements

The proposed Millbury station will be constructed on a vacant, wooded tract of land in the extreme northerly corner of town, north of the railroad and just west of the former Millbury Junction. The station locus map and site plan are shown on Figures 6.1-1 and 6.1-2.

The access drive will be a new 3,000 foot long roadway, beginning at a new intersection on Route 20 opposite the Big Y shopping center entrance. The westerly end of the station driveway will traverse industrial property. The location of the roadway has been designed to minimize effects on truck access to the businesses, and no buildings will be acquired.

Near the Worcester City line, the access road traverses one house lot of a recent expansion of an existing residential subdivision. A new street, which was constructed in 1995, has not yet been paved, and the impacted lot is vacant.

The proposed access road will be 26 feet wide. Paved shoulders will be provided to accommodate bike riders and the occasional pedestrian. The intersection of the access road and Route 20 will be signalized and the new signal coordinated with the existing signal at Route 20 and Sunderland Road.

The station layout includes paved parking for 300 vehicles, two 800-foot long low-level access boarding platforms including two 45-foot long raised access platforms for the disabled, a passenger drop-off area, a pedestrian bridge over the tracks with stairs and ramps, station canopy, site lighting, landscaping and bike racks. Intertrack fencing will be installed to discourage pedestrian crossing of the tracks.

The station site, including the 300-car parking lot, will involve acquisition of approximately 5 acres of land. The access drive will involve acquisition of about 4 acres of land, including a portion of one subdivision house lot.

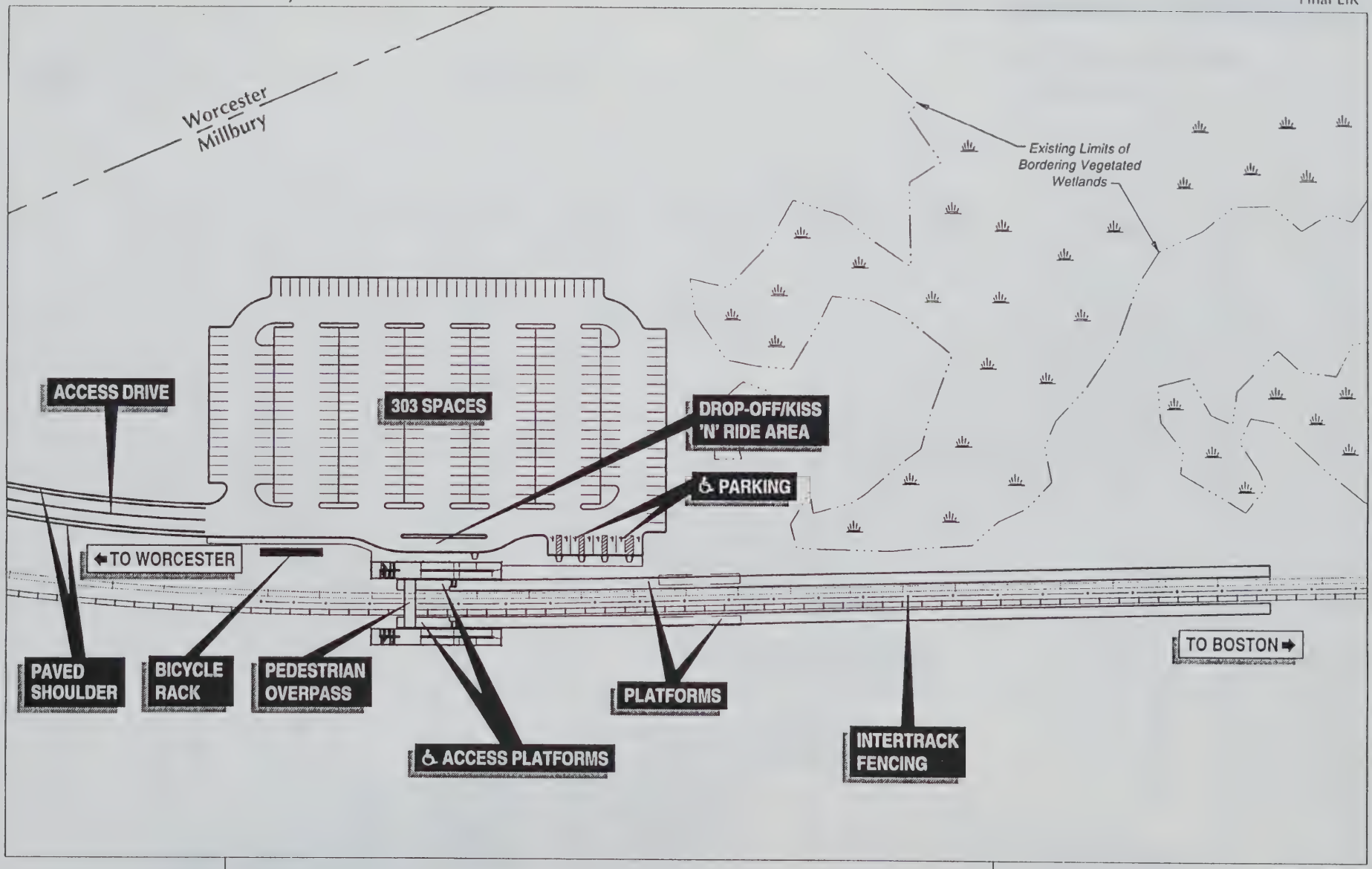
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 800'

0 800

LOCUS MAP
MILLBURY STATION

FIGURE 6.1-1



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 125'
0 125

SITE PLAN
MILLBURY, MA

FIGURE 6.1-2

6.2 Local Traffic

This section provides a summary of the complete traffic analysis included in the November 1994 DEIR Appendix, Volume I, Section 1.0. This section summarizes existing traffic conditions in Millbury, projected ridership for the Millbury Station and the impact of that ridership on area streets and intersections.

The traffic analysis prepared for the Millbury Station focused on the streets and intersections listed in the Certificate of the Secretary of Environmental Affairs on the ENF. Figures 6.2-1 (A.M. Peak Hour) and 6.2-2 (P.M. Peak Hour) show the location of the streets and intersections that were analyzed as part of the study.

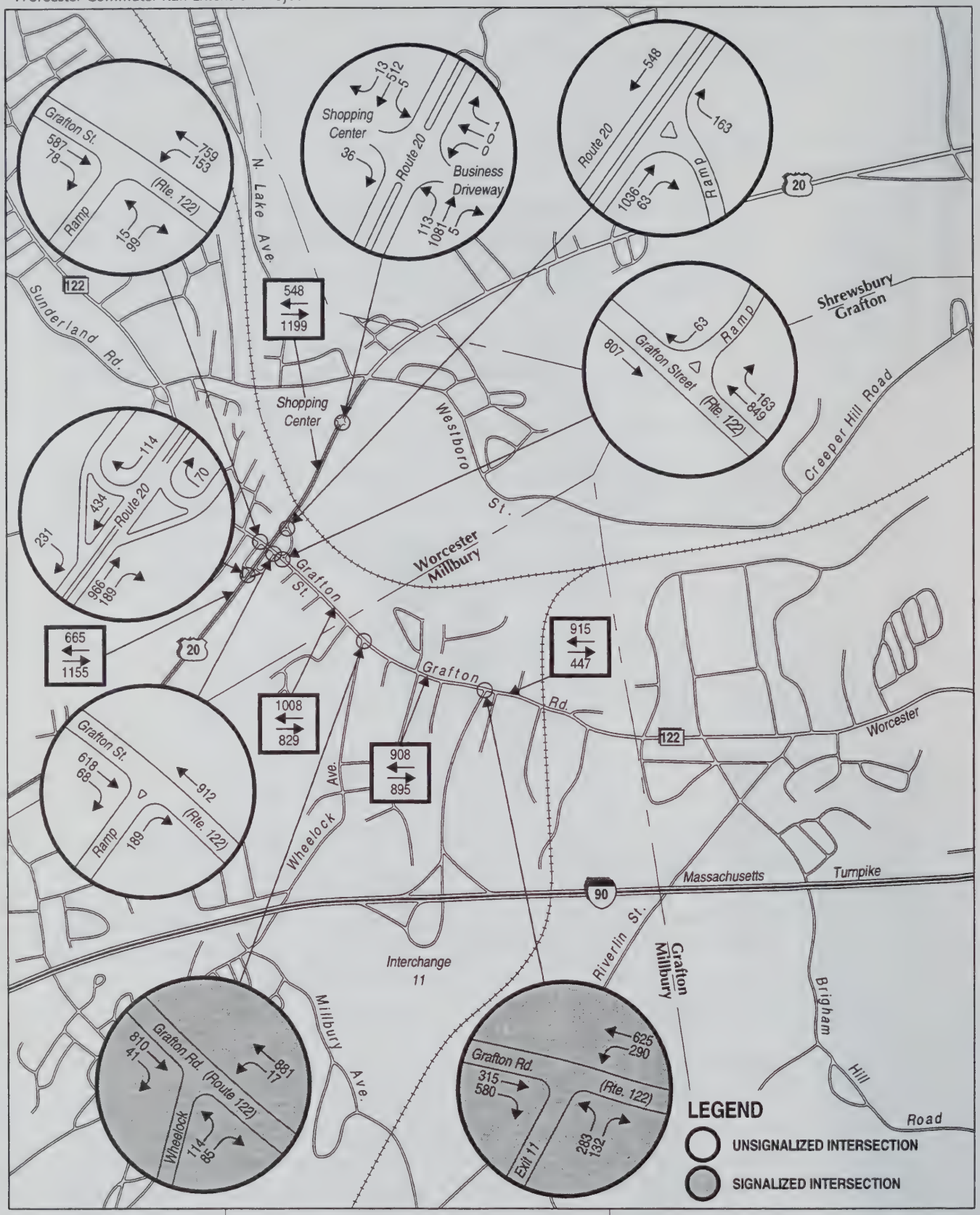
Analysis of the streets and intersections was performed for the existing conditions and the "No Build" and "Build" conditions for the years 1996 and 2001. A level of service (LOS) was calculated for each street segment and intersection. A discussion of the LOS rating system was presented in Section 1.1 of the November 1994 DEIR Appendix, Volume I. A summary of the LOS designations is as follows:

Rating	Judgment
A	Little or no delay
B	Short traffic delays
C	Average traffic delays
D	Longer than average delays
E	Very long traffic delays
F	Severe congestion, demand exceeds capacity

The results of the LOS analysis are presented for the A.M. and P.M. peak hours as well as the A.M. and P.M. peak generator hours. The A.M. and P.M. peak hours are those periods when traffic conditions are heaviest. The A.M. and P.M. peak generator hours are those periods when usage of the rail station is heaviest. Traffic count data showed that the A.M. and P.M. peak hours in Millbury are from 7:15 to 8:15 A.M. and 5:00 to 6:00 P.M., respectively. The A.M. and P.M. peak generator hours are from 6:45 to 7:45 A.M. and 6:00 to 7:00 P.M., respectively.

Existing Conditions

Existing conditions were determined by traffic counts and intersection turning movement counts conducted in the Fall of 1992 and the Spring of 1993. The results of the counts were used to calculate existing condition levels of service for each of the intersections and street segments studied. Figures 6.2-1 and 6.2-2 show existing A.M. and P.M. peak hour volumes within the study area. Figure 6.2-3 shows existing Average Daily Traffic (ADT) and Average Weekday Traffic (AWDT) for roads within the study area.



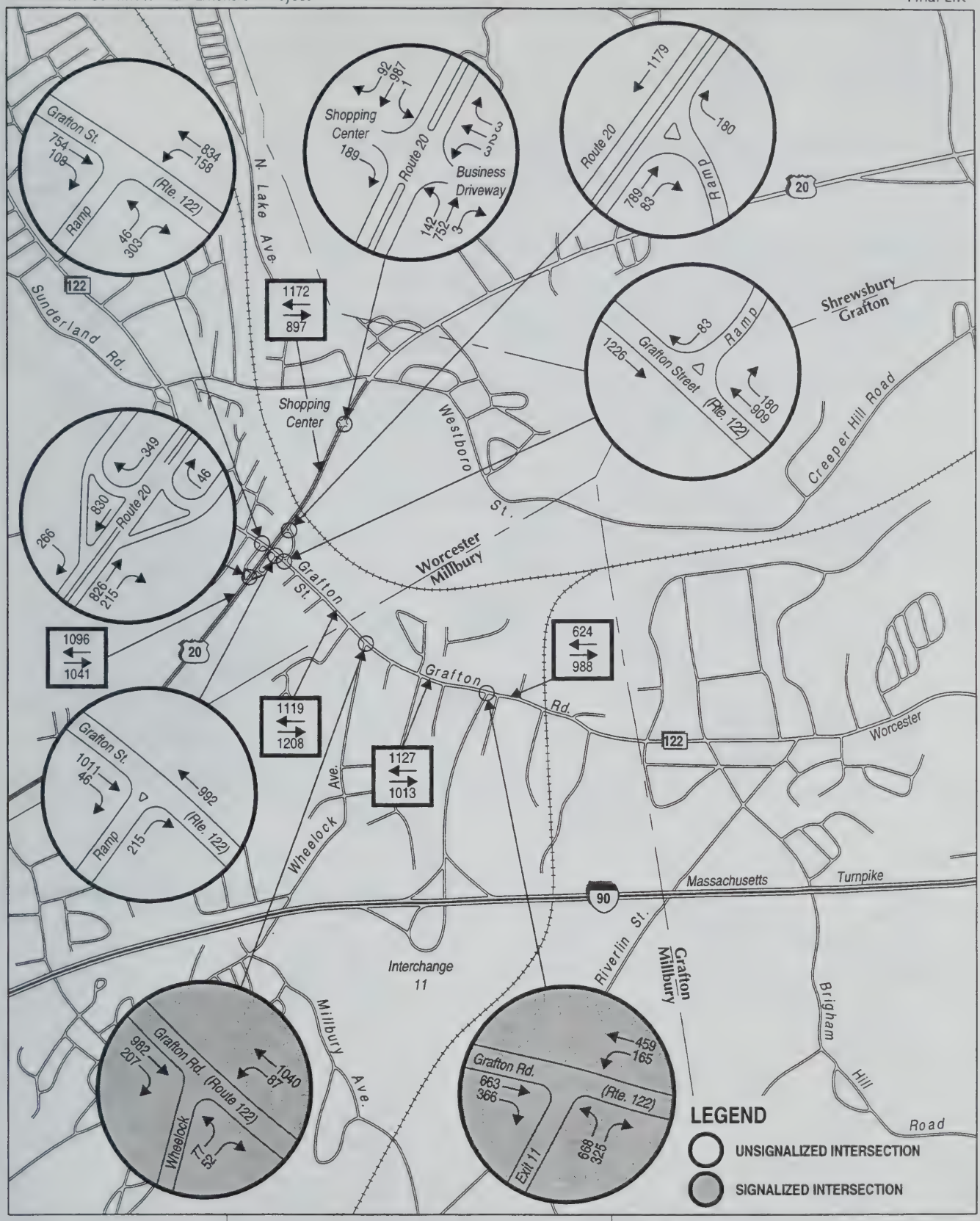
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

0 1750

A.M. Peak Hour
7:15 - 8:15 A.M.
1992 Existing Conditions
Millbury Station

FIGURE 6.2-1



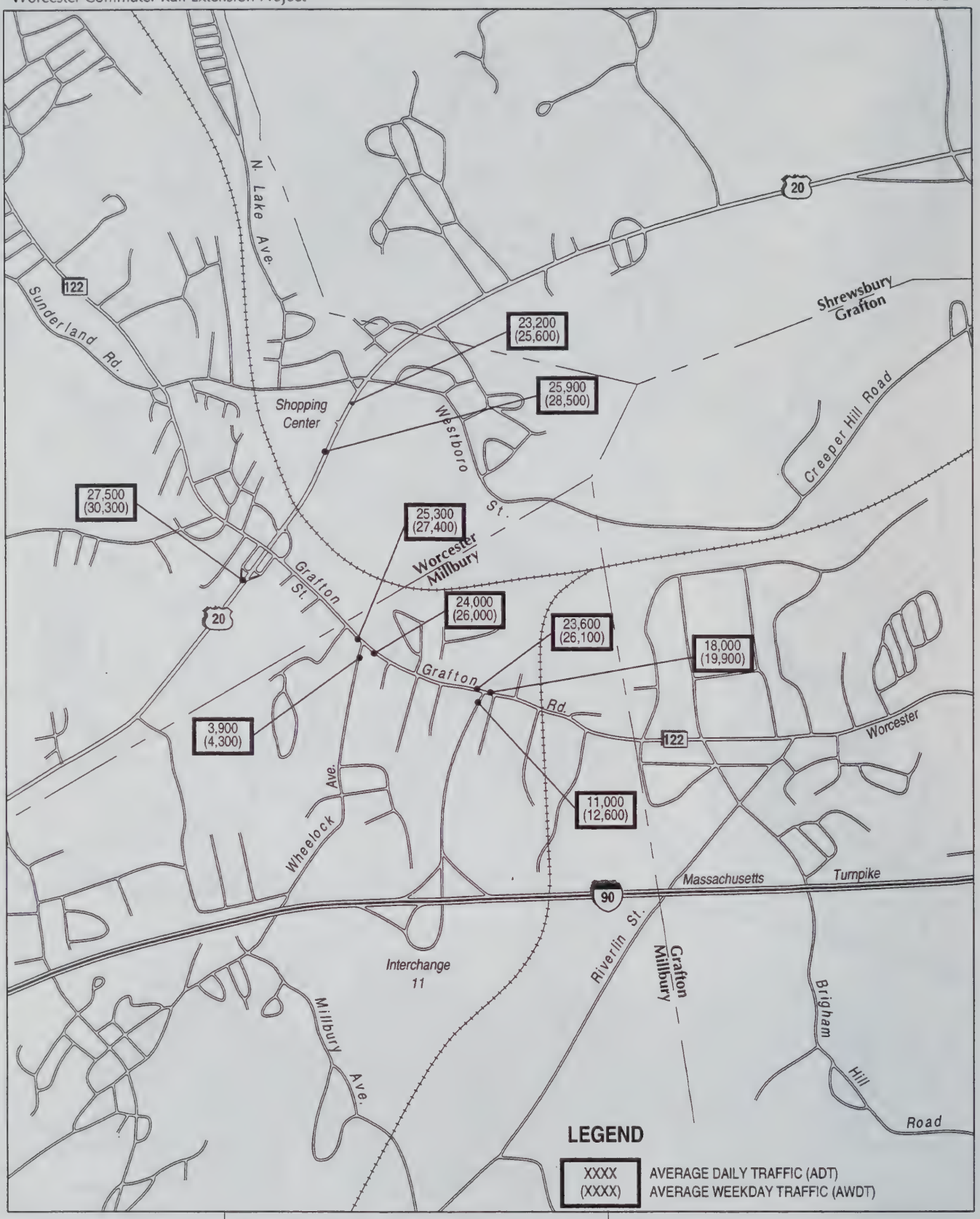
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

0 1750

P.M. Peak Hour
5:00 - 6:00 P.M.
1992 Existing Conditions
Millbury Station

FIGURE 6.2-2



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

0 1750

1992 Average Daily Traffic and 1992 Average Weekday Traffic Millbury, MA

FIGURE 6.2-3

Table 6.2-1 shows the signalized intersection levels of service and Table 6.2-2 shows the unsignalized intersection levels of service. Roadway segment levels of service are shown in Table 6.2-3.

As shown in the tables, both the signalized and unsignalized intersections generally operate at acceptable levels of service in both the peak hours and peak generator hours. Traffic entering Grafton Street in Worcester from westbound Route 20 and traffic entering Route 20 from the existing truck business experience LOS F in the P.M. peak hour.

Table 6.2-3 indicates that for the most part the analyzed road segments are operating satisfactorily. Route 20 west of Route 122 functions at a low LOS E in the A.M. and P.M. peak hour, while Route 122 west of Exit 11 is at a low LOS E in the P.M. peak hours.

Table 6.2-1 1992 Existing Signalized Intersection LOS - Millbury

Millbury (Route 20)	Peak Hour		Peak Generator Hour	
	A.M.	P.M.	A.M.	P.M.
Route 122 and Exit 11	B	D	B	B
Eastbound - Route 122	A	C	A	B
Westbound - Route 122	A	C	A	B
Northbound - Exit 11	B	E	B	B
Route 122 and Wheelock	A	B	A	A
Eastbound - Route 122	A	A	A	A
Westbound - Route 122	A	B	A	A
Northbound - Wheelock	B	B	B	B

Table 6.2-2 1992 Existing Unsignalized Intersection LOS - Millbury

Millbury (Route 20)	Peak Hour		Peak Generator Hour	
	A.M.	P.M.	A.M.	P.M.
Grafton and Route 20 West				
LT from NB Grafton	B	C	A	A
LT and RT from Ramp	E	F	D	D
SB Grafton and Route 20 East				
RT from Ramp	C	E	B	B
NB Grafton and Route 20 East				
RT from Ramp	C	C	B	B
WB Route 20 and Grafton				
RT from Ramp to WB 20	A	C	A	B
EB Route 20 and SB Grafton				
RT from Ramp to EB 20	A	A	A	A
EB Route 20 and NB Grafton				
RT from Ramp to EB 20	B	A	A	A
Route 20 and Mall				
LT from EB Route 20	A	D	A	B
LT from WB Route 20	C	B	B	A
All from Truck Business	A	F	D	D
RT from Mall	A	B	A	A

Table 6.2-3 1992 Existing Road Segment LOS - Millbury

Millbury (Route 20)	Peak Hour		Peak Generator Hour	
	A.M.	P.M.	A.M.	P.M.
Route 122 East of Exit 11	E	E	D	D
Route 122 West of Exit 11	E	E	E	E
Route 122 West of Wheelock	E	E	E	E
Route 20 West of Route 122	E	E	E	E
EB Route 20 West of Mall	B	A	A	A
WB Route 20 West of Mall	A	B	A	A

The Millbury Police Department was contacted on June 21, 1994 to determine the existence and location of any safety concerns or high accident locations. Chief Handfield indicated that no existing serious safety concerns or high accident locations currently exist within the MBTA study area in the Town of Millbury.

In Worcester, concern has been expressed about the safety aspects of Route 20, especially in the section of Route 20 near the proposed station access driveway. After an initial consultation with the Worcester Police Department, the Massachusetts Highway

Department's accident records were obtained and evaluated. The most recent accident data available was for the year 1993. A total of nine accidents were reported at the signalized intersection of Route 20 with Sunderland Road. Six of these accidents were angle collisions which indicate a conflict between turning vehicles and the through traffic flow. The roadway section between Sunderland Road on the north and Route 122 on the south experienced 26 accidents in 1993, almost half were angle collisions and almost half were rear end collisions. Poor channelization and high speed could be contributing factors to the these type of accidents, but uncontrolled access and turns against moving traffic are likely factors also.

Rail Ridership Projections

Projections of rail ridership for each of the proposed new stations of the Worcester Commuter Rail Extension project were prepared by the Central Transportation Planning Staff (CTPS) in May 1994. The results of this planning analysis were included in the Draft EIR and Appendix Volume I, circulated for review in November 1994.

The Draft EIR presented 1996 traffic projections and analyses for two alternatives—the first assumed all five intermediate stations were built (the proposed project), and the second was a "worst case" that assumed only the Millbury Station would be built in 1996.

Ridership projections were updated by CTPS in January 1996 to address review comments on the DEIR, to evaluate regional station alternatives, and to develop ridership estimates for a scenario in which Millbury and Grafton were the only intermediate stations. The updated CTPS ridership projections are discussed in Section 4.3 and included in Appendix D of this FEIR.

Build All Stations

CTPS projected that in 1996, the Millbury Station would attract a total of 149 daily round-trip commuters. None of these patrons would walk to the station, and twelve are projected to be dropped off. The remaining 137 patrons would drive to and park at the station.

Based on a vehicle occupancy rate of 1.12, the 137 Park'n'Ride patrons would result in a demand for 123 parking spaces.

Under the build-all stations scenario, patrons of the Millbury Station are projected to originate in the towns of Millbury, Oxford, Charlton, Auburn and Worcester. Table 6.2-4 shows the town of origin distribution.

Build Millbury and Grafton Only

The updated CTPS projections included analysis of a scenario in which Millbury and Grafton were the only intermediate stations operational in 1996. In this case, Millbury ridership would increase to 161 patrons. None of the patrons will walk to the station; 13 will be dropped off, and 148 will park at the station, creating a demand for 132 spaces. The distribution of ridership by town of origin is shown in Table 6.2-4.

Build Millbury Only

A "worst case" analysis presented in the DEIR included projections of ridership for a "Millbury Only" alternative, in which case an estimated 347 persons per day would use the Millbury Station. Ridership would be attracted from the adjoining towns as well as several communities east of Millbury, as shown in Table 6.2-4.

Of the projected 347 riders, none would walk to the station; 28 would be dropped off; and 319 would park, creating a demand for 285 spaces.

Table 6.2-4 Town of Origin of Projected Ridership, Millbury Station-Year 1996

Town	All Stations	Millbury and Grafton Only	Millbury Only
Millbury	26	28	30
Oxford	17	19	19
Charlton	17	18	21
Auburn	27	29	29
Worcester	62	67	68
Shrewsbury			82
Grafton			37
Sutton			16
Boylston			17
Northbridge			28
Totals	149	161	347

Assignment of Riders to Trains

Commuter rail riders to the Millbury Station would arrive at the station site to board one of four A.M. peak period trains and would leave the station in the P.M. peak period based on the five scheduled P.M. peak period trains. The distribution of riders to each train was determined by use of an equation based on observed arrival and departure data from several MBTA commuter rail lines. The observations of distribution by train show the greatest number of riders on the trains arriving at Boston close to 8:30 A.M. Trains arriving earlier and trains getting to Boston after 9:00 A.M. attract fewer riders. In the

evening peak, the observations also show greater ridership in the middle of what is normally considered peak commuting period.

1996 Traffic Impacts - Build All Stations

"No Build" Traffic Volumes

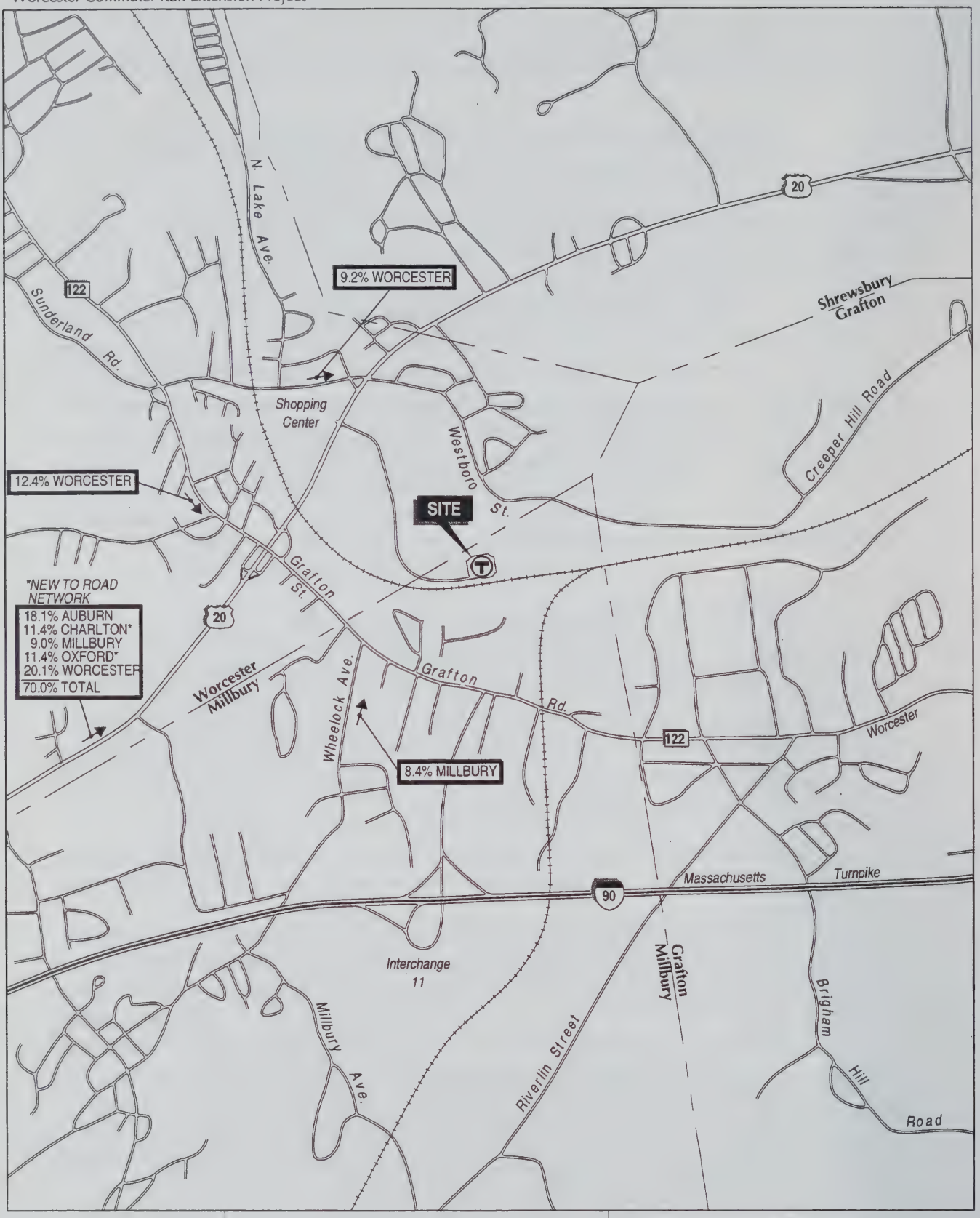
To assess the traffic impacts of the "Build" alternative, the 1996 "No Build" is used as a point of reference. To obtain 1996 "No Build" traffic volumes, the 1992 existing volumes were increased to account for background growth in traffic. The rate of growth to be employed is usually determined by analyzing historical trend data at permanent traffic count station. During the 1980s, traffic volumes typically increased at rates of 2-3 percent per year in many areas. Data from a permanent traffic count location in Millbury on Route 122 showed that the most recent trend to be no growth. As a conservative approach, 0.5 percent annual growth was used to derive 1996 "No Build" volumes from the 1992 existing conditions volumes.

"Build" Traffic Volumes

The "Build" alternative did not assume any redistribution of existing traffic on local roads. In other words, the commuters driving to the rail station were considered to be new trips. In actuality, many of those who would drive to the station are already on the road. Their trip will be shortened by driving to the station. In some cases, they are already driving on the same roads to access Route 20 or the Turnpike, for example, as they would to go to the new station. The "Build" analysis, therefore, does some double counting of vehicles and tends to be a worst case analysis.

To establish the "Build" traffic volumes, the commuter rail station traffic was assigned to particular routes in the study area based on the town of origin (as given in Table 6.2-4).

The impact of the commuter rail riders on area streets as they travel to the Millbury Station is determined by assigning those commuters to a particular route within the study area. Patrons who live in Millbury essentially have two basic routes to access the station. These are Wheelock Avenue to Route 122 westbound to Route 20 eastbound or directly on Route 20 to the station. The patrons who live in the City of Worcester will access the station by following routes: Sunderland Road to Route 20 westbound, Route 122 southbound to Route 20 eastbound, or directly on Route 20 eastbound to the station. The patrons from Auburn, Charlton, and Oxford are expected to use Route 20 eastbound to the station. Figure 6.2-4 shows the distribution and percentages of station related traffic that would use the area roadways.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

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Distribution of Commuter Rail Station Traffic
1996 BUILD ALL STATIONS
Millbury Station

FIGURE 6.2-4

The traffic volumes for both a "No Build" and "Build" alternative were prepared. Levels of service were calculated for both the A.M. and P.M. peak hours and peak generator hours. The 1996 "No Build" alternative allows for a comparison with the 1996 "Build" alternative to determine if the additional traffic to or from the proposed commuter rail station will adversely impact the road network within the study area. In developing the "Build" alternative traffic volumes the commuter rail patrons from Auburn, Millbury, and Worcester currently accessing the MassPike at Exit 11 are considered by-pass traffic and therefore are not considered as new traffic to the study area. Traffic signal warrants were checked at the Route 20/Mall intersection to determine if signalization is warranted after construction of the rail station. The P.M. peak hour and the P.M. peak generator hour volumes met the requirements for signal warrants.

Since most of the commuters from the Millbury Station will desire to make a left turn when exiting the station, it is proposed that this intersection be signalized and coordinated with the traffic signals at the intersection of Route 20 with Sunderland Road and Westborough Street. Analysis of the 1996 "Build" condition assumed signalization of this intersection.

In Millbury the peak hour and peak generator hour overlap by 30 minutes in the A.M. period and do not overlap in the P.M. period. Both peak hours and peak generator hours were analyzed to determine the greatest impact to the roadway network.

Tables 6.2-5 through 6.2-8 present the results of the LOS analysis for the signalized and unsignalized intersections. The tables reflect both "No Build" and "Build" conditions.

As shown in the "No Build" condition, both existing signalized intersections operate at acceptable levels of service. In the "Build" condition, the two existing signalized intersections as well as the proposed signalized intersection will have acceptable levels of service.

Generally, in both the "No Build" and "Build" conditions the unsignalized intersections are operating satisfactorily. As in the existing condition, traffic egressing westbound Route 20 to Grafton Street in Worcester will operate at LOS F in the P.M. peak hour. This occurs in both the "No Build" and "Build" conditions.

Tables 6.2-9 and 6.2-10 show the results of the road segment LOS analysis for the peak hours and peak generator hours.

As shown, the road segments are at LOS E or better in both the "No Build" and "Build" conditions. Route 20 west of Route 122 operates at a low LOS E in the "No Build" and "Build" conditions, Route 122 west of Wheelock Avenue and Route 122 west of Exit 11 are at a low LOS E in the peak hour "Build" condition.

Table 6.2-5 1996 Signalized Intersection LOS - A.M. Peak Hours

Millbury (Route 20)	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 and Exit 11	B	B	A	A
Eastbound - Route 122	A	A	A	A
Westbound - Route 122	A	A	A	A
Northbound - Exit 11	B	B	B	A
Route 122 and Wheelock	A	B	A	A
Eastbound - Route 122	A	A	A	A
Westbound - Route 122	A	B	A	A
Northbound - Wheelock	B	B	B	C
Route 20, Mall and Station Driveway	-	B	-	B
Eastbound - Route 20	-	B	-	B
Westbound - Route 20	-	B	-	B
Northbound - MBTA Drive	-	D	-	D
Southbound - Mall Drive	-	D	-	B

Table 6.2-6 1996 Signalized Intersection LOS - P.M. Peak Hours

Millbury (Route 20)	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 and Exit 11	D	D	B	B
Eastbound - Route 122	C	C	B	B
Westbound - Route 122	D	D	B	B
Northbound - Exit 11	E	E	B	B
Route 122 and Wheelock	B	B	A	A
Eastbound - Route 122	A	A	A	A
Westbound - Route 122	B	B	A	A
Northbound - Wheelock	D	D	C	C
Route 20, Mall and Station Driveway	-	B	-	B
Eastbound - Route 20	-	B	-	B
Westbound - Route 20	-	B	-	B
Northbound - MBTA Drive	-	D	-	D
Southbound - Mall Drive	-	C	-	C

Table 6.2-7 1996 Unsignalized Intersection LOS - A.M. Peak Hours

Millbury (Route 20)	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Grafton and Route 20 West				
LT from NB Grafton	B	B	B	B
LT and RT from Ramp	E	E	D	D
SB Grafton and Route 20 East				
RT from Ramp	C	B	C	B
NB Grafton and Route 20 East				
RT from Ramp	C	C	B	B
WB Route 20 and Grafton				
RT from Ramp to WB 20	A	A	A	A
EB Route 20 and SB Grafton				
RT from Ramp to EB 20	B	B	A	A
EB Route 20 and NB Grafton				
RT from Ramp to EB 20	B	B	A	B
Route 20 and Mall				
LT from EB Route 20	A	-	A	-
LT from WB Route 20	C	-	C	-
All from Truck Business	A	-	D	-
RT from Mall	A	-	A	-

Table 6.2-8 1996 Unsignalized Intersection LOS - P.M. Peak Hours

Millbury (Route 20)	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Grafton and Route 20 West				
LT from NB Grafton	C	C	A	A
LT and RT from Ramp	F	F	D	E
SB Grafton and Route 20 East				
RT from Ramp	E	E	B	B
NB Grafton and Route 20 East				
RT from Ramp	C	C	B	B
WB Route 20 and Grafton				
RT from Ramp to WB 20	C	C	B	B
EB Route 20 and SB Grafton				
RT from Ramp to EB 20	A	A	A	A
EB Route 20 and NB Grafton				
RT from Ramp to EB 20	A	A	A	A
Route 20 and Mall				
LT from EB Route 20	D	-	B	-
LT from WB Route 20	B	-	A	-
All from Truck Business	F	-	D	-
RT from Mall	C	-	A	-

Table 6.2-9 1996 Road Segment LOS - A.M. Peak Hours

Millbury (Route 20)	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 East of Exit 11	E	E	D	D
Route 122 West of Exit 11	E	E	E	E
Route 122 West of Wheelock	E	E	E	E
Route 20 West of Route 122	E	E	E	E
EB Route 20 West of Mall	B	B	A	B
WB Route 20 West of Mall	A	A	A	A

Table 6.2-10 1996 Road Segment LOS - P.M. Peak Hours

Millbury (Route 20)	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 East of Exit 11	E	E	D	D
Route 122 West of Exit 11	E	E	E	E
Route 122 West of Wheelock	E	E	E	E
Route 20 West of Route 122	E	E	E	E
EB Route 20 West of Mall	A	A	A	A
WB Route 20 West of Mall	B	B	A	A

1996 Traffic Impacts - Millbury and Grafton Stations Only

The Draft EIR presented traffic projections and analyses for 1996 for two alternatives. The first assumed all intermediate stations were built (the proposed project), and the second was a "worst case" that assumed only the Millbury Station was built by 1996. The current plan is that only Millbury and Grafton will be operational in 1996 (in addition to the present Worcester Station).

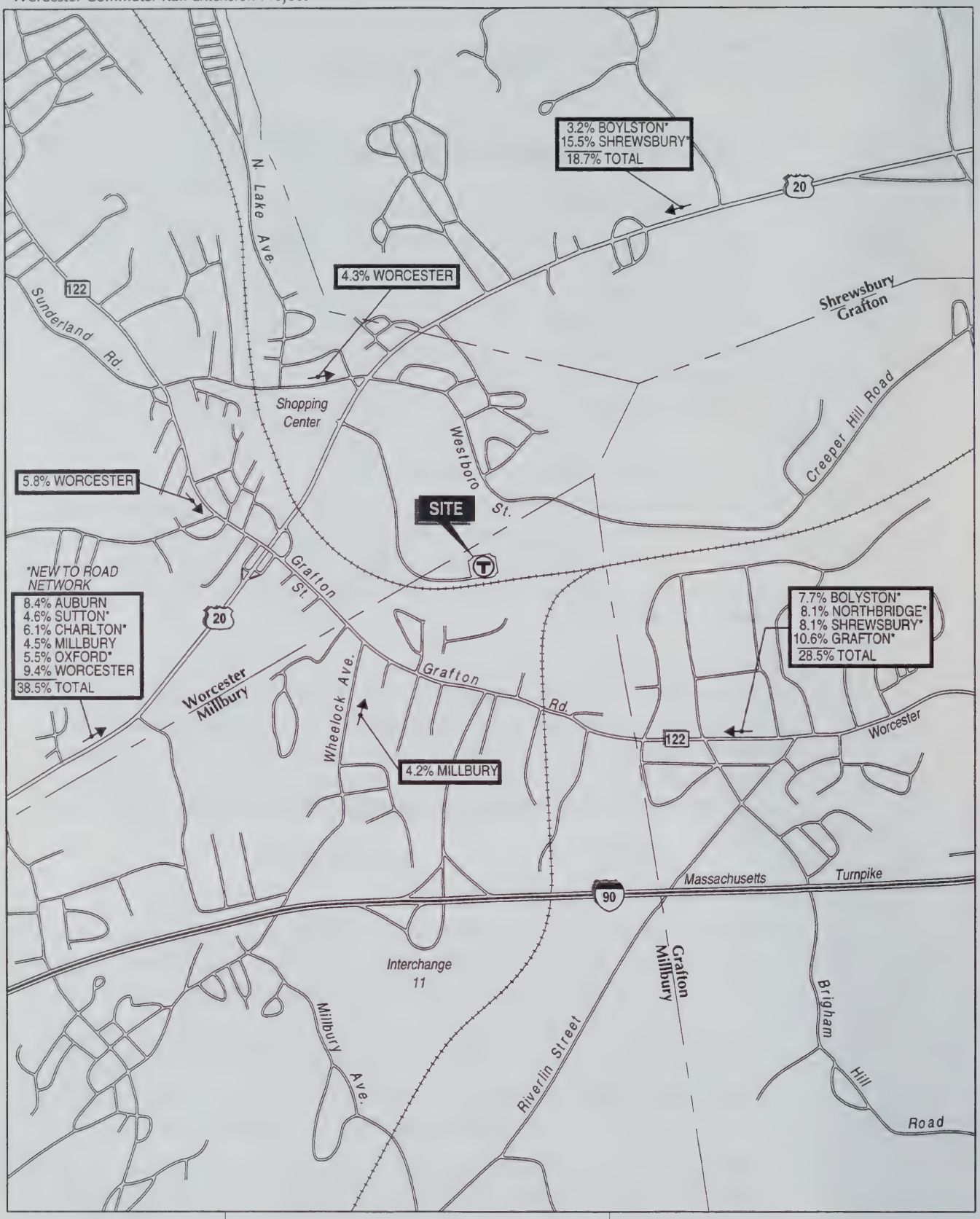
During the interim when Millbury and Grafton are the only intermediate stations in service, Millbury will attract a projected 161 riders each workday in 1996, an increase of only 12 over the "Build All Stations" scenario ridership of 149. The additional ridership would be uniformly distributed over the same towns as for the "Build All Stations" scenario (Table 6.2-4) and would not result in any quantifiable change in traffic LOS for any of the analyzed intersections or road segments described for Build All Stations previously.

1996 Traffic Impacts - Millbury Station Only

In order to address an upper limit, worst case situation with regard to traffic impacts on area roadways, an analysis was performed which considered that the Millbury commuter station was the only commuter station built by 1996 (in addition to a Worcester Station).

CTPS projected that under this scenario the Millbury Station would attract 347 daily round trip commuters, 319 of which would be Park'n'Ride patrons. Site traffic was distributed over the roadway network in a manner similar to that used for the 1996 "Build All Stations" scenario. The projected distribution of traffic is shown in Figure 6.2-5.

A LOS analysis was performed for the peak hour and peak generator hour "Build" condition. The "No Build" condition is the same as previously presented in the "Build All Stations" scenario.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

0 1750

Distribution of Commuter Rail Station Traffic
1996 BUILD Millbury Only
Millbury Station

FIGURE 6.2-5

The results of the LOS analysis for the signalized and unsignalized intersections is shown in Tables 6.2-11 through 6.2-14.

Both existing signalized intersections will operate at acceptable levels of service in the "No Build" condition. In the "Build" condition the existing signalized intersections as well as the proposed signalized intersection will have acceptable levels of service. No reduction in level of service will occur at the existing signalized locations in the "Build" condition.

The unsignalized intersections for the most part operate satisfactorily in both the "No Build" and "Build" conditions. As the tables indicate, several movements would experience some reduction in LOS in the "Build" condition. As in the existing condition, the turning movement from westbound Route 20 to Grafton Street in Worcester will operate at LOS F in the P.M. peak period. This occurs under both the "No Build" and "Build" conditions.

Tables 6.2-15 and 6.2-16 list the findings of the analysis of the road segments.

All of the road segments are functioning at LOS E or better for both "No Build" and "Build" conditions. Route 20 west of Route 122, Route 122 west of Wheelock Avenue and Route 122 west of Exit 11 all function at a low LOS E during certain peak periods in both the "No Build" and "Build" conditions.

Table 6.2-11 1996 Signalized Intersection LOS - A.M. Peak Hours (Millbury Station Only)

Millbury (Route 20)	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 and Exit 11	B	B	A	A
Eastbound - Route 122	A	A	A	A
Westbound - Route 12	A	A	A	A
Northbound - Exit 11	B	B	B	B
Route 122 and Wheelock	A	A	A	A
Eastbound - Route 122	A	A	A	A
Westbound - Route 122	A	A	A	A
Northbound - Wheelock	B	B	B	B
Route 20, Mall and Station Driveway	-	B	-	B
Eastbound - Route 20	-	B	-	B
Westbound - Route 20	-	B	-	B
Northbound - MBTA Drive	-	D	-	D
Southbound - Mall Drive	-	D	-	C

Table 6.2-12 1996 Signalized Intersection LOS - P.M. Peak Hours (Millbury Station Only)

Millbury (Route 20)	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 and Exit 11	D	D	B	B
Eastbound - Route 122	C	C	B	B
Westbound - Route 122	D	D	B	B
Northbound - Exit 11	E	E	B	B
Route 122 and Wheelock	B	B	A	A
Eastbound - Route 122	A	A	A	A
Westbound - Route 122	B	B	A	A
Northbound - Wheelock	D	D	C	C
Route 20, Mall and Station Driveway	-	C	-	C
Eastbound - Route 20	-	B	-	B
Westbound - Route 20	-	B	-	B
Northbound - MBTA Drive	-	C	-	D
Southbound - Mall Drive	-	D	-	C

Table 6.2-13 1996 Unsignalized Intersection LOS - A.M. Peak Hours (Millbury Station Only)

Millbury (Route 20)	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Grafton and Route 20 West				
LT from NB Grafton	B	B	B	B
LT and RT from Ramp	E	E	D	D
SB Grafton and Route 20 East				
RT from Ramp	C	B	C	B
NB Grafton and Route 20 East				
RT from Ramp	C	C	B	B
WB Route 20 and Grafton				
RT from Ramp to WB 20	A	A	A	A
EB Route 20 and SB Grafton				
RT from Ramp to EB 20	B	B	A	A
EB Route 20 and NB Grafton				
RT from Ramp to EB 20	B	C	A	B
Route 20 and Mall				
LT from EB Route 20	A	-	A	-
LT from WB Route 20	C	-	C	-
All from Truck Business	A	-	D	-
RT from Mall	A	-	A	-

Table 6.2-14 1996 Unsignalized Intersection LOS - P.M. Peak Hours (Millbury Station Only)

Millbury (Route 20)	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Grafton and Route 20 West				
LT from NB Grafton	C	C	A	A
LT and RT from Ramp	F	F	D	E
SB Grafton and Route 20 East				
RT from Ramp	E	E	B	B
NB Grafton and Route 20 East				
RT from Ramp	C	C	B	B
WB Route 20 and Grafton				
RT from Ramp to WB 20	C	C	B	B
EB Route 20 and SB Grafton				
RT from Ramp to EB 20	A	A	A	A
EB Route 20 and NB Grafton				
RT from Ramp to EB 20	A	A	A	A
Route 20 and Mall				
LT from EB Route 20	D	-	B	-
LT from WB Route 20	B	-	A	-
All from Truck Business	F	-	D	-
RT from Mall	C	-	A	-

Table 6.2-15 1996 Road Segment LOS - A.M. Peak Hours (Millbury Station Only)

Millbury (Route 20)	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 East of Exit 11	E	E	D	E
Route 122 West of Exit 11	E	E	E	E
Route 122 West of Wheelock	E	E	E	E
Route 20 West of Route 122	E	E	E	E
EB Route 20 West of Mall	B	B	A	A
WB Route 20 West of Mall	A	A	A	A

Table 6.2-16 1996 Road Segment LOS - P.M. Peak Hours (Millbury Station Only)				
Millbury (Route 20)	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 East of Exit 11	E	E	D	D
Route 122 West of Exit 11	E	E	E	E
Route 122 West of Wheelock	E	E	E	E
Route 20 West of Route 122	E	E	E	E
EB Route 20 West of Mall	A	A	A	A
WB Route 20 West of Mall	B	B	A	A

2001 Traffic Impacts

The level of service analysis was conducted for the Millbury Station study area using year 2001 "No Build" and "Build" traffic volumes. To account for normal background traffic growth, an annual growth factor of 1.5% was applied to the 1996 "No Build" volumes to develop the 2001 "No Build" volumes.

CTPS projected that the Millbury Station would attract a total of 162 daily round trip commuters to Boston. It projected that 149 of the commuters would be Park'n'Ride patrons. Projected percentage distribution of traffic is essentially the same as shown in Figure 6.2-4.

The LOS analysis was conducted for both the peak hour and peak generator hour "No Build" and "Build" condition. As in the 1996 analysis, the intersection of Route 20 and the Mall was analyzed as a signalized intersection in the 2001 "Build" condition.

The results of the LOS analysis for the signalized and unsignalized intersections are presented in Tables 6.2-17 through 6.2-20.

The analysis indicates that the signalized intersection of Route 122 and Exit 11 will experience LOS F conditions in the P.M. peak hour "No Build" condition. The intersection will also operate at LOS F in the P.M. peak hour "Build" condition. The Route 122/Wheelock Avenue intersection operates acceptably in both "No Build" and "Build" conditions. The proposed signalized intersection at Route 20 and the Mall will function acceptably in the "Build" condition.

While several unsignalized intersection movements will experience some reduction in LOS in the "Build" condition, most will continue to function at acceptable levels. As in the previous analyses, failure conditions exist in the P.M. peak hour under both the "No Build" and "Build" conditions for traffic turning from westbound Route 20 to Grafton

Street in Worcester. This movement will deteriorate from a low LOS E to LOS F in the A.M. peak hour "Build" condition.

Tables 6.2-21 and 6.2-22 present the road segment LOS results.

All segments will function at LOS E or better under both the "No Build" and "Build" conditions. As in the existing condition and the 1996 condition analyses Route 20 west of Route 122 will operate at a low LOS E. A reduction in capacity due to normal background traffic growth will cause Route 122 west of Exit 11 and Route 122 west of Wheelock to experience a low LOS E in the peak periods. This will occur with or without construction of a commuter rail station.

Table 6.2-17 2001 Signalized Intersection LOS - A.M. Peak Hours

Millbury (Route 20)	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 and Exit 11	B	B	A	A
Eastbound - Route 122	A	A	A	A
Westbound - Route 122	B	B	A	A
Northbound - Exit 11	B	B	B	B
Route 122 and Wheelock	A	A	A	A
Eastbound - Route 122	A	A	A	A
Westbound - Route 122	A	A	A	A
Northbound - Wheelock	B	B	B	C
Route 20, Mall and Station Driveway	-	A	-	B
Eastbound - Route 20	-	A	-	B
Westbound - Route 20	-	B	-	B
Northbound - MBTA Drive	-	D	-	D
Southbound - Mall Drive	-	D	-	B

Table 6.2-18 2001 Signalized Intersection LOS - P.M. Peak Hours

Millbury (Route 20)	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 and Exit 11	F	F	B	B
Eastbound - Route 122	C	C	B	B
Westbound - Route 122	F	E	B	B
Northbound - Exit 11	F	F	B	B
Route 122 and Wheelock	B	B	A	A
Eastbound - Route 122	A	A	A	A
Westbound - Route 122	C	B	A	A
Northbound - Wheelock	E	E	C	C
Route 20, Mall and Station Driveway	-	B	-	B
Eastbound - Route 20	-	B	-	B
Westbound - Route 20	-	B	-	B
Northbound - MBTA Drive	-	C	-	D
Southbound - Mall Drive	-	C	-	C

Table 6.2-19 2001 Unsignalized Intersection LOS - A.M. Peak Hours

Millbury (Route 20)	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Grafton and Route 20 West				
LT from NB Millbury	B	C	B	B
LT and RT from Ramp	E	F	D	E
SB Grafton and Route 20 East				
RT from Ramp	C	C	C	C
NB Grafton and Route 20 East				
RT from Ramp	C	C	B	B
WB Route 20 and Grafton				
RT from Ramp to WB 20	A	A	A	A
EB Route 20 and SB Grafton				
RT from Ramp to EB 20	B	B	A	A
EB Route 20 and NB Grafton				
RT from Ramp to EB 20	C	C	B	B
Route 20 and Mall				
LT from EB Route 20	B	-	A	-
LT from WB Route 20	D	-	C	-
All from Truck Business	A	-	E	-
RT from Mall	A	-	A	-

Table 6.2-20 2001 Unsignalized Intersection LOS - P.M. Peak Hours

Millbury (Route 20)	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Grafton and Route 20 West				
LT from NB Millbury	C	C	B	A
LT and RT from Ramp	F	F	E	E
SB Grafton and Route 20 East				
RT from Ramp	E	E	B	B
NB Grafton and Route 20 East				
RT from Ramp	D	D	B	B
WB Route 20 and Grafton				
RT from Ramp to WB 20	D	D	B	B
EB Route 20 and SB Grafton				
RT from Ramp to EB 20	A	A	A	A
EB Route 20 and NB Grafton				
RT from Ramp to EB 20	B	B	A	A
Route 20 and Mall				
LT from EB Route 20	E	-	C	-
LT from WB Route 20	B	-	A	-
All from Truck Business	F	-	E	-
RT from Mall	C	-	A	-

Table 6.2-21 2001 Road Segment LOS - A.M. Peak Hours

Millbury (Route 20)	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 East of Exit 11	E	E	E	E
Route 122 West of Exit 11	E	E	E	E
Route 122 West of Wheelock	E	E	E	E
Route 20 West of Route 122	E	E	E	E
EB Route 20 West of Mall	B	B	B	B
WB Route 20 West of Mall	A	A	A	A

Table 6.2-22 2001 Road Segment LOS - P.M. Peak Hours				
Millbury (Route 20)	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 122 East of Exit 11	E	E	D	D
Route 122 West of Exit 11	E	E	E	E
Route 122 West of Wheelock	E	E	E	E
Route 20 West of Route 122	E	E	E	E
EB Route 20 West of Mall	A	A	A	A
WB Route 20 West of Mall	B	B	A	A

Summary of Findings

The analysis indicates that traffic generated by the proposed commuter rail station on Route 20 would not significantly impact level of service at any of the locations within the study area. Much of the traffic that would use the commuter rail station is existing traffic already utilizing the roads to access the Turnpike at Exit 11. This reduces the amount of new traffic introduced to the road network. Currently, the turning movements at the ramp from westbound Route 20 to Grafton Street in Worcester operate at unacceptable levels. This situation is due to the substandard design of the interchange and will continue with or without construction of a rail station.

In summary, while general improvements to increase capacity are warranted on both Route 122 and Route 20, traffic generated by the proposed commuter rail station will not adversely impact the operating characteristics of the roadways.

6.3 Air Quality

Carbon monoxide (CO) is a colorless, odorless gas produced by the incomplete combustion of motor vehicle fuels. When combined with hemoglobin in the blood, it reduces the ability of the blood to carry oxygen. When people are exposed to increased CO levels, they may suffer headaches, nausea, a reduction in work rates and an increase in response time to stimuli. Extremely high concentrations can be fatal. In accordance with accepted practice, CO is the pollutant which is to be analyzed for public health effects at the microscale level. The U.S. Environmental Protection Agency (EPA) and the Massachusetts DEP have established air quality standards for CO to protect the public health and welfare. The CO standards are 35 ppm (parts per million) for the maximum 1-hour period and 9 ppm for the maximum 8-hour average. Both standards are not to be

exceeded more than once per year. Carbon monoxide concentrations generally correlate well with traffic volumes.

Employing worst case traffic and meteorological conditions, a microscale analysis was performed to address the 1-hour and 8-hour standards at receptors adjacent to signalized intersections in each proposed station community. The "Build" versus the "No Build" situations were addressed for the year 1996 only since by year 2001 emissions are less due to a relatively small increase in traffic being more than offset by improved emission controls on most vehicles. The local air quality impacts are addressed at signalized intersections (existing or proposed) which have the greatest potential for CO impacts. Unsignalized intersections generally are of lesser concern for air quality impacts, since the queued traffic and acceleration/deceleration functions primarily affect only the lower traffic volumes on the cross street.

Emission rates were generated using the EPA's Mobile 5a Emission model based on Massachusetts input files provided by the DEP in July 1994. The analysis was conducted using EPA's CAL3QHC program. The program predicts CO concentrations for receptors up to 150 meters from the roadway source. Peak A.M. traffic data were used for the predictions.

Due to a lack of site specific CO levels, background levels of CO have been estimated conservatively at 3 ppm for the 1-hour period and 2 ppm for the average 8-hour period. The background levels are consistent with those normally used by the DEP in suburban or urban areas.

Additional information on the air quality analyses is contained in the DEIR, Appendix Volume II, Section 6.0, circulated in November 1994.

Employing the rationale and methodology described above, the intersection of Route 122 with Massachusetts Turnpike Exit 11 was selected for analysis. The intersection exhibits the traffic volumes and queued traffic which were determined to produce the highest CO concentrations (see Figure 6.2-1). The proposed signalized intersection at the MBTA station driveway on Route 20 in Worcester does not have the traffic characteristics or sensitive receptors that exist at the Exit 11/Route 122 intersection.

In order to simulate the highest CO concentrations, receptor locations were established along the sidewalk northerly of the intersection, approximately 50-feet east and west of the traffic signals. The results for year 1996 are as follows in Table 6.3-1.

Table 6.3-1 1996 CO Concentrations - Route 122/Exit 11 Intersection, Millbury				
	1-Hour CO (ppm)		8-Hour CO (ppm)	
	No Build	Build	No Build	Build
Northeast Sidewalk	5.8	6.7	4.1	4.7
Northwest Sidewalk	5.2	5.6	3.6	3.9

Although the predicted concentrations are slightly higher for the "Build" versus the "No Build" condition, all values are well below the 35 ppm for the 1-hour standard and 9 ppm for the 8-hour standard. Additional receptors evaluated included 3 single-family residences and the Liberty Heights Bar, all located northerly of the sidewalk locations evaluated. The predicted concentrations for the 1-hour case range from 3.6 ppm for "No Build" to 4.2 ppm for the "Build" condition. Similarly the 8-hour values range from 2.5 ppm to 2.9 ppm. There are no other intersections affected by station generated traffic that would exhibit higher CO concentrations.

6.4 Noise and Vibration

Noise Impact Analysis Methodology

Because of slow train speeds near stations, the potential for noise and vibration impacts from train operations are at a minimum compared to other segments of the right-of-way. There is, however, the potential for noise and vibration effects near the station because of project-induced traffic on roads leading to and from station areas, as well as short-term effects during construction of platforms, parking, and other site facilities.

Traffic Noise

The significance of noise impacts from project-generated traffic near proposed commuter rail stations along the corridor was assessed based on the projected noise increase relative to the noise from existing traffic on applicable roads. Because the greatest changes in traffic volumes are expected to occur during peak commuting periods, the noise increase was evaluated in terms of the peak-hour L_{eq}.

Criteria for traffic noise impact are based on FTA guidelines, which state that a noise level increase of greater than 5 dBA is considered to represent impact. Where the existing layout of major roads will essentially remain the same, the traffic noise assessment predicts only the change in noise resulting from the projected change in traffic volumes near the stations, and not the absolute traffic noise levels at specific noise-sensitive locations in the community.

The traffic noise analysis was carried out on a relative basis, by estimating the change in peak-hour traffic noise, which is a function of the change in peak-hour traffic volume. The assumption is that all other non-project related noise sources remain unchanged.

Construction Noise and Vibration

The construction of a fixed facility such as a commuter rail station is expected to include clearing, excavation, foundation work, equipment installation, paving and finishing. Construction machinery is likely to include the types of equipment typically used for light industrial construction, such as graders, bulldozers, backhoes, cranes and trucks. Construction will typically occur during 8 to 10 hour weekday, daytime periods.

Construction of the station can be categorized in two distinct operations—parking lots and platform areas—with total duration of construction estimated to be approximately six to eight months.

For a typical station site, the distance to significant noise impact was estimated to be 200 feet measured from the closest area of construction. In cases where noise-sensitive land uses were concentrated in a location very close to either the platform area or the parking area, separate screening distances were used to assess the two construction scenarios.

Station construction noise exposure was estimated using equipment noise levels and scenarios that are typical for non-residential construction (EPA, 1971). Usage factors were assigned to each piece of equipment to determine a cumulative reference noise level to use in determining the width of the noise impact zone.

Noise impact criteria for construction are based on the outdoor Annual Average Day-Night Equivalent Sound Level (AA L_{dn}), with a threshold of 65 AA L_{dn} defining the impact zone. This metric is slightly less conservative than the 24-hour L_{dn} used for train noise impact, given the short-term nature of construction noise impact. (A complete definition of metrics and terms pertaining to noise and vibration used in this report is given in the DEIR, Appendix Volume II, Section 3.)

The impact criteria for construction vibration are essentially the same as for train operations, except that impact is assessed only when the activity will occur for 30 days or more at a given location. Ground-borne vibration from construction was estimated based on equipment source data found in literature (Wiss, 1974; FHWA, 1982; FTA, 1990) . Vibration projections were made for the main equipment categories, based on the relative amount of energy imparted to the ground. Details on this methodology are given in the DEIR Appendix, Volume II, Section 3. A screening distance of 85 ft measured from nearest area of construction was estimated for vibration impact from general construction activity at stations.

Traffic Noise Impacts

The proposed layout of Millbury Station includes an access road which will bring traffic from Route 20 to the station. The future peak-hour L_{eq} was estimated based on a projected peak-hour traffic volume, and compared to the background L_{eq} during the peak hour (minus the contribution from trains). This is a principle similar to using the increase in traffic volume to estimate the increase in noise, except that in this case the existing traffic volume is zero and the comparison is made with the ambient level.

The new road crosses an undeveloped lot of an expansion of an existing residential subdivision abutting the Worcester City line. The proposed station traffic of approximately 160 automobile trips in the A.M. and P.M. commuting hours, will not generate a significant noise level in the adjacent residential subdivision.

For residences located on Grafton Road (Route 122),the existing traffic noise is already relatively high, in the range of 60 to 65 dBA during the peak hour. The projected peak hour traffic volume on this road is estimated to increase by a factor of about 1.02, resulting in only a fraction of a decibel increase in noise level. There will be a similar change on Route 20 in the vicinity of the MBTA driveway; however there are no sensitive noise receptors along this segment of roadway. Therefore, no significant noise impact is expected from project-induced traffic increases and/or modifications near the Millbury Station site.

Construction Noise and Vibration Impacts

The nearest portions of the proposed station parking are at least 300 feet from the nearest homes in the residential subdivision northerly of the site. Thus, the homes are located beyond the 200 feet screening distance for construction noise impact.

Traffic Noise Mitigation

No significant traffic noise impact was identified for Millbury Station.

Construction Noise and Vibration Mitigation

No significant construction noise or vibration impact was identified for Millbury Station.

6.5 Wetlands and Drainage

The site of the proposed Millbury Station is located in the northernmost corner of the Town of Millbury, just north of the railroad tracks and within the Blackstone River

Watershed. The parking lot site consists of wooded areas with irregular topography. Wetland resources border the site to the east and hilly wooded areas with rock outcrops border the site to the west. The station will be accessed by a new 3,000-foot long road beginning at Route 20 just opposite the Big Y Shopping Center driveway. Construction of portions of the driveway will require rock excavation. An underdrain system will be installed through areas of rock excavation.

Site area stormwater currently drains in an easterly direction into the wetland resources, and then flows in a small stream northeasterly to Flint Pond. Runoff from a portion of the proposed access drive tributary area currently flows in a westerly direction, towards Route 20. The remaining area drains to an isolated wetland located approximately 100 feet west of this new roadway.

A Best Management Practices (BMP) plan will include a regular parking lot sweeping program, catch basins equipped with sumps and oil and grease traps, and the installation and maintenance of a siltation control barrier during construction. Additional water quality BMP alternatives including stilling basins and vegetated swales will be discussed with the Millbury Conservation Commission prior to final design.

A stormwater detention basin also will be designed to mitigate any impacts generated by stormwater runoff from the proposed parking lot, and to ensure that no increase in the peak rate of flow occurs. The detention basin will be sized to accommodate stormwater runoff generated by storms up to and including the 100 year event. An outlet control structure will be designed to release stormwater at a controlled rate which will not exceed existing flow rates under the 10 and 100 year events. Table 6.5-1 compares peak runoff rates for the 10 and 100 year storm events. Watershed mapping, TR-55 analysis and computer generated hydrographs are included in the DEIR Appendix Volume II, Section 5.

Table 6.5-1 Peak Runoff Rates Millbury Station Route 20 Alternative

Storm Event	Existing Conditions	Proposed Conditions
10 Year	11.7 cfs	10.4 cfs
100 Year	28.8 cfs	21.8 cfs

Wetland resources in the vicinity of the Millbury Station site include a pond with associated bordering vegetated wetlands that lies generally north of the existing railroad embankment, east of Route 20 and south of the proposed access drive. There is no defined outlet from the pond but the drainage patterns seem to flow towards the trucking facility drainage system. The area to the rear of the trucking facility appears to have been disturbed by past earth moving operations. The proposed access drive will require some grading within the 100-foot buffer zone of the pond and bordering wetlands. The

alignment of the drive has been designed to avoid wetland impacts and grading will be at least 75 feet from the resource area.

A bordering vegetated wetland (see Figure 6.1-2) with a mature red maple (Acer rubrum) tree canopy and a woody understory lies to the east of the proposed parking lot and adjacent to the railroad. The topography is pit and mound and a shallow stream channel drains to a tributary stream of Flint Pond. The parking lot has been configured to avoid the wetlands but will be within the 100-foot buffer zone. Coordination will be carried out with the Millbury Conservation Commission during the final design process.

Water Supply

The Town of Millbury is serviced by a private water company, the Massachusetts American Water Works Company. The nearest well, according to the Superintendent of Operations, is the Oak Pond Well on Wheelock Street, approximately one mile southwest of the station site. The Millbury Station is not expected to have any impact on water supply.

6.6 Historic Structures

The proposed Route 20 site of the MBTA station in Millbury is wooded. It is adjacent to a cluster of large mid-to-late twentieth-century freight storage and transfer structures. These are served daily by a variety of trucks and so will not be impacted by locating a train station nearby.

No potentially historic properties are located near the MBTA rail line as it passes through Millbury.

6.7 Archaeological Resources

Physical Environment

The proposed station occupies broadly level terrain on the eastern side of a rocky knoll, overlooking a small vegetated wetland. No significant disturbance is evident in this parcel, except that associated with construction and maintenance of the existing rail bed. The proposed station access road crosses an industrial parking lot before cutting across the rocky knoll.

Methods

The aims of intensive surveys include "locating and identifying the sites which exist in a given area" (950 CMR 70.04). In view of the topographic characteristics of the proposed station construction parcels, the patterns of prehistoric site location, and the expected character of prehistoric and historic settlement, a combination of systematic testing in blocks of subsurface shovel test pits is the most effective approach to satisfying these requirements.

Testing involves three steps.

1. Intensive-survey testing along other portions of the rail corridor indicates that disturbance is much more pervasive than is evident from surface indications. Accordingly, each station area will be subject to systematic subsurface soil probes, or cores, to determine the presence and extent of disturbance. The soil probes will be arranged in a grid at 10-m. intervals, and the soil profiles will be recorded on a standard sheet.

2. Subsurface testing will then be undertaken with systematic shovel test pits. If the preliminary soil probes have indicated extensive disturbance, the disturbance will be confirmed with one or more preliminary shovel test pits. In the event extensive disturbance is confirmed, the subsequent shovel test-pit program may be curtailed or eliminated, as the situation warrants.

   The testing will occur in 50 x 50 m. blocks, each block containing 22 shovel test pits arranged in a checkerboard pattern at 10-m. intervals. Three test blocks will be placed in the Millbury station. This size and number of test blocks allows optimum flexibility to avoid detected disturbance and slope, and at the same time offers a high coverage of the proposed station areas (50% of the Millbury station area). In addition, a transect of five test pits at 10-m. intervals will be placed in the access road within 100 m. of the Millbury station area. This systematic testing thus plans 71 test pits at the proposed Millbury station.

3. In addition to these systematic shovel test pits, both judgmental and bracketing test pits will be employed as necessary. Five to ten judgmental test pits will be placed in topographically promising locations that escape the systematic testing blocks in each station area. This is to say that selected locations will be those that are flat, undisturbed, and, especially, overlooking the wetlands to the west. Bracketing test pits will be placed next to test pits that contain prehistoric or early historic materials, in order to confirm the presence of archaeological sites.

The test pits will be square, measuring 50 cm. to a side. They will be excavated by shovel into glacial till or sand; trowels will be used to investigate soil anomalies and to straighten test pit sections for recording. Excavation will observe natural soil stratigraphy, and the sediments from the individual levels of each pit will be dry-screened through quarter-inch wire mesh; the cultural contents of each natural level will be recorded and stored separately. The location, stratigraphy and cultural contents will be recorded for each test pit on standard forms. Recovered artifacts will be placed in plastic bags, together with provenience information (transect and pit number, stratigraphic level, and date), for later processing and analysis.

Once returned to the laboratory, recovered artifacts will be cleaned, identified, and described. Description of artifacts will encompass (where appropriate) material, style, manufacturing technique, date, and behavioral implication; this information will be entered and stored in a computer cataloguing system. This descriptive analysis will provide the information necessary to identify the archaeological sites within the station locations, and to interpret the activities that they represent in light of the background contexts (environment, prehistory, history). The analysis will also form the basis for recommendations about the need for additional field investigation (site examination) in order to determine significance and eligibility for listing in the National Register of Historic Places. After analysis, artifacts will be placed in plastic bags or in acid-free containers, along with provenience information and copies of the test-pit forms and the survey report, for curation.

Results

Completion of the Millbury Station archaeological intensive survey has been delayed due to weather. Approximately 15% of the proposed test pits have been performed. The laboratory analyses of the recovered material indicate that no resources were encountered. Further testing at the site will continue as soon as ground conditions allow. The completion of the work and the mitigation contingencies are covered in the proposed Memorandum of Agreement in Appendix H.

6.8 Visual Impacts

The station will be within sight of only a few residential properties and, generally, is in an isolated area. The nearest residence, located in the Flint Pond subdivision, is approximately 340 feet from the edge of the proposed parking lot and is separated from the lot by relatively dense vegetation. This separation, combined with landscaping and

lighting design mitigation discussed in this section, should limit the visibility of the station and any visual effects on its neighbors.

The design elements of the commuter rail station will represent a marked visual contrast with the undeveloped nature of the existing site. The station, however, will be well removed from most houses and there will be opportunities for landscaped buffer zones and fencing to maintain a separation between the uses.

The major visual features will be the parking lot and the pedestrian overpass structure and a protective canopy on the in-bound platform located on the south side of the tracks.

The pedestrian overpass will connect the north and south sides of the tracks with the platforms and the parking lot. The overpass will clear the tracks by 21 feet and, with its canopy, have a total elevation of about 30 feet above the tracks. Covered stairways and a covered access ramp will connect to the overpass on either side of the tracks. Fencing will discourage crossing the tracks at grade. The overpass will be a dominant feature near the tracks but will be less visible at a distance due to the wooded nature of much of the surroundings.

Cost-effective, high-pressure sodium light fixtures on 30-foot poles will be used for lighting the parking lot. The fixtures will be of the cut-off type which direct lighting downward with minimum spillover to adjoining properties. The light source from such fixtures is visible only to someone standing directly under the light. The lights will be on from dusk to one-half hour after the last train arrives in the evening. Photoelectric switches will turn the lights on and a time clock will turn them off.

Overall, the proposed project will have a minimal visual impact with the exception of some visual changes to the few residential houses which are close to the parking lot.

6.9 Hazardous Materials

An environmental site evaluation was performed for the proposed Millbury Station Route 20 Alternative. The purpose of the evaluation was to determine whether surficial or historical evidence indicated that hazardous materials or oil were present in soil or groundwater at the site, within the meaning of Massachusetts General Laws, Chapter 21E. The purpose of 21E and its implementing regulations (310 CMR 40.00 - The Massachusetts Contingency Plan) is to "ensure the protection of health, safety, public welfare, and the environment by establishing requirements and procedures for the discovery, notification, assessment of, and response to, releases and threats of releases

of oil or hazardous materials, and by identifying these oils and hazardous materials which are subject to these requirements and proceedings."

The environmental site evaluation was limited to the proposed parking lot area and did not extend along the alignment of the access road to Route 20. The site evaluation included the following elements:

1. A review of the site's history, which concluded that the site has been vacant and undeveloped since the mid 1800s.
2. A review of state and local records, which indicated no record of spills/releases of hazardous materials or oil at the project site.
3. A site reconnaissance to observe surficial conditions for evidence of hazardous materials or oil.

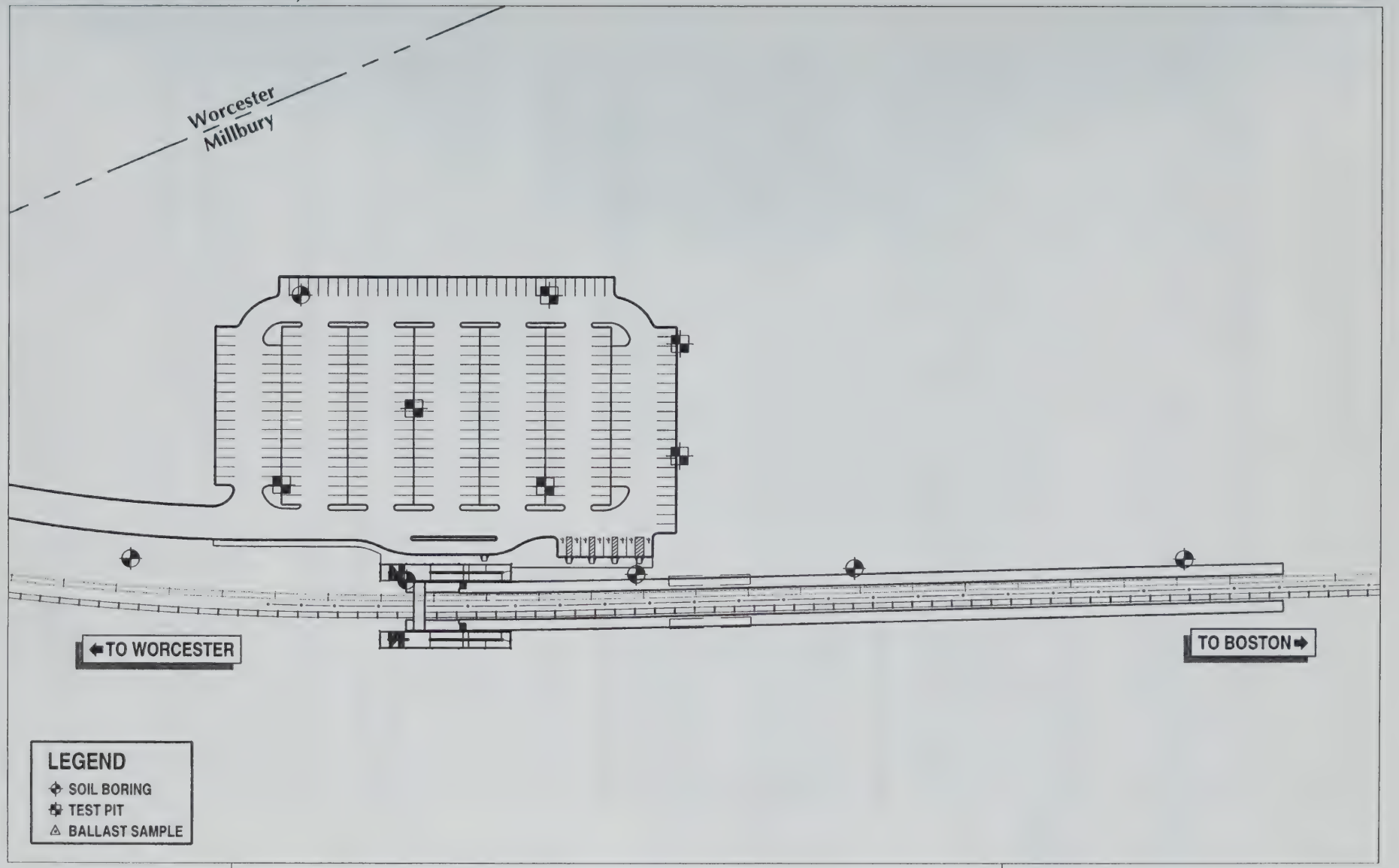
The results of the environmental site evaluation rendered the opinion that, although no surficial evidence of spills/releases of hazardous materials or oil were detected in the residential and undeveloped areas, oil and hazardous materials may be present within the soils and groundwater at the project site. This opinion is based on the following:

- The Wyman-Gordon facility is located within ½ mile of the project site.
- Barrett Centrifugals is located within ¼ mile and upgradient of the site.
- The use of hazardous materials and oils, predominantly paints and oil, by Barrett Centrifugals, along with the presence of an on-site septic system receiving waste water from sinks and drains in production areas of the building, presents a potential for hazardous materials/oil to be released to the soil and groundwater via the septic system.

A comprehensive subsurface exploration program for the site is in progress and will be completed prior to any final design or construction activities. (See Figure 6.9-1 for location of proposed soil borings and test pits.)

6.10 Pedestrian Safety

The CTPS ridership projections do not forecast any patrons walking to the Millbury Station. Although the proposed access road from Route 20 to the station does not connect to any pedestrian attractions, a paved shoulder will be provided for bikes and the occasional walker.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 125'
0 125

SITE PLAN - HAZARDOUS MATERIALS INVESTIGATION (21E) MILLBURY, MA

FIGURE 6.9-1

As noted elsewhere, intertrack fencing will be constructed through the station area to discourage pedestrian crossing of the tracks. A pedestrian bridge, accessible to the handicapped, will be constructed over the tracks to connect station platforms to parking facilities.

6.11 Construction

Construction related impacts typically involve issues of traffic to and from the work site, air quality, noise and vibration, erosion and sedimentation, and safety. Station site work will involve clearing, excavation, foundation construction, paving and installing/erection of site facilities such as pedestrian bridges and station canopies. Construction equipment likely to be used includes graders, bulldozers, backhoes, cranes and trucks.

Construction related traffic impacts are not expected to be significant. During certain short-term phases of construction, there will be concentrated deliveries of materials, such as during paving of the parking areas. Station construction will not be particularly labor-intensive, either, and traffic generated by the labor force will not adversely affect level of service on nearby roads. Access to the station site will require construction of the proposed driveway as the initial phase of work.

There will be short-term, intermittent increases in emissions from construction equipment and site-related construction traffic. No violations of air quality standards are anticipated.

The application of water by spraying exposed earth surfaces will minimize the potential for fugitive dust from construction vehicle traffic or from wind erosion.

Silt barriers, consisting of hay bales and silt fence are effective in trapping sediments from construction site runoff. Limiting the area of earth exposed at any one time can be effective in minimizing both wind and water erosion. Compliance with the requirements of an order-of-conditions issued by the Millbury Conservation Commission will ensure that adverse effects on water quality and resource areas are minimized.

No potential construction noise and vibration impacts were identified, as described in the preceding Section 6.4.

Station site construction activities that present a potential safety concern would be secured by temporary fencing or other barriers. The Contractor will be required to adhere to all pertinent regulations regarding use and storage of hazardous or toxic materials on the site.

6.12 Proposed Mitigation

The traffic analyses of roads and intersections within the Millbury Study area were reviewed to identify locations which may require mitigation in accordance with the MBTA Mitigation Policy outlined in Section 3.7.

To mitigate safety and level of service concerns at the proposed station access drive intersection at Route 20, the MBTA will install a new traffic signal system. The new station driveway and the existing driveway to the Big Y shopping center will be designed to operate as a single, four leg intersection. The proposed signal will allow for protected left turns from the driveways. The signal will be interconnected with the existing signal at Route 20 and Sunderland Road to provide for signal timing coordination.

Elements of the Millbury Station have been sited to avoid direct impact of wetland resources. A Best Management Plan has been developed for the station, and a stormwater detention basin will be constructed to ensure no increase in peak rate of runoff. The project elements will be reviewed by the Millbury and Worcester Conservation Commissions and construction will be in compliance with any Order of Conditions issued.

The project landscape architect will design plantings which will limit the visibility of the station from nearby residences. Appropriate fencing will be considered as part of the shielding scheme.

SECTION 7.0 ENVIRONMENTAL IMPACTS—GRAFTON STATION

Introduction

The proposed commuter rail station in Grafton, with parking for 265 vehicles, will be constructed west of Pine Street and north of Westborough Road (Route 30) and the railroad tracks (see Figures 7.1-1 and 7.1-2).

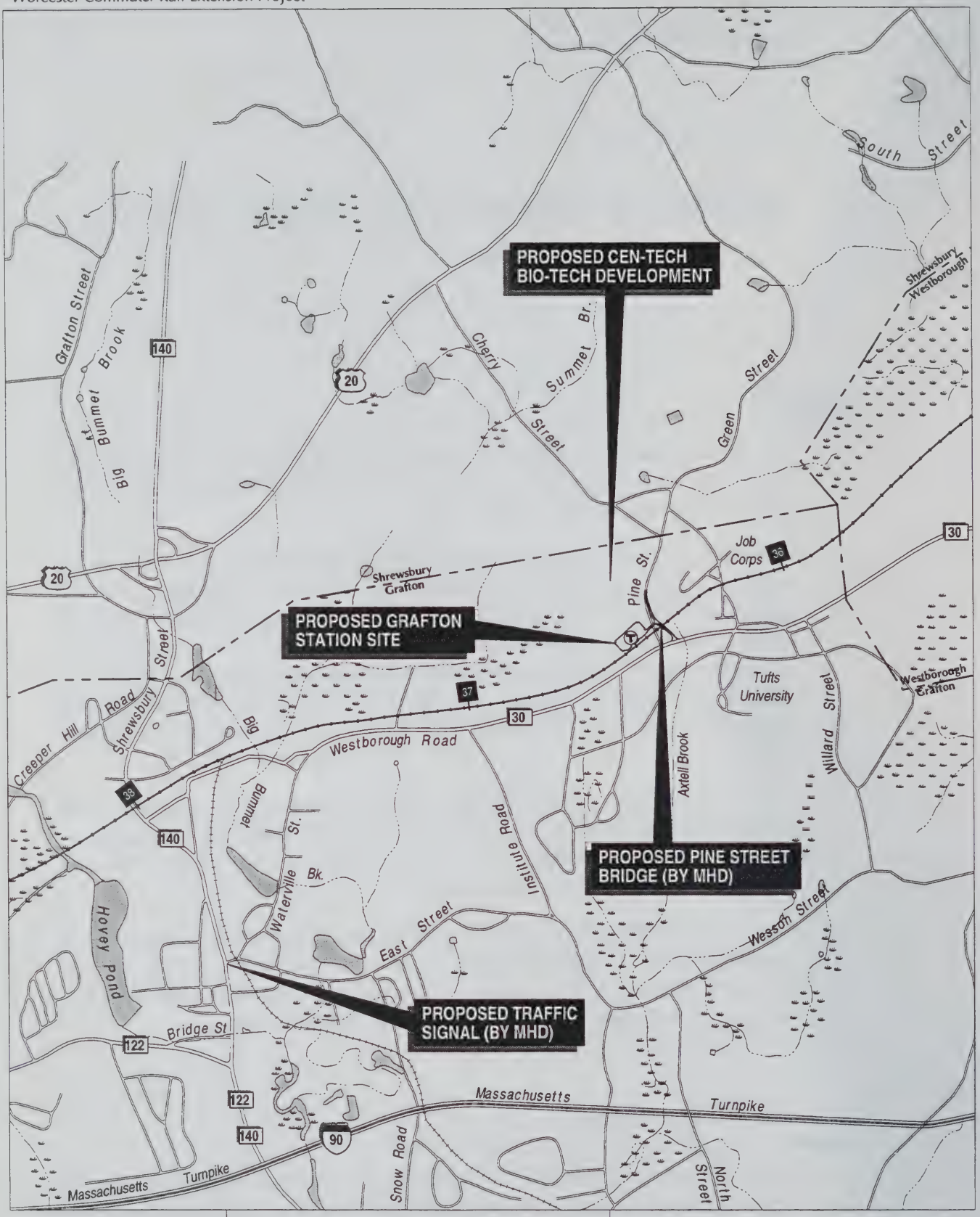
If all five intermediate stations were open in 1996, the Pine Street station is projected to attract 116 patrons with daily ridership increasing to 149 by the year 2011. Under the present timetable, only Millbury and Grafton Stations will be placed in service by the end of 1996, resulting in a short-term ridership of 216. The increase is primarily patrons who would have used the Westborough Station. Station generated traffic is not expected to result in any significant impact on existing levels of service for local streets. During construction, short-term noise and vibration impacts could occur at two residences on Route 30.

The station site construction will displace wetland resources, in addition to work within the buffer zone. A detention pond is proposed to maintain stormwater discharge flows at or below existing conditions. All work affecting resource areas will be coordinated with the Grafton Conservation Commission.

The Pine Street bridge is proposed for reconstruction by the Massachusetts Highway Department under its ongoing program for replacement of functionally obsolete and structurally deficient bridges. Design and construction of the Pine Street bridge is scheduled to be compatible with the commuter rail station construction.

7.1 Grafton Station Elements

The proposed Grafton Station will be constructed on a vacant tract of land located north of the railroad tracks and west of Pine Street (Figure 7.1-1). The land, formerly part of the Grafton State Hospital property, was owned by the Commonwealth of Massachusetts



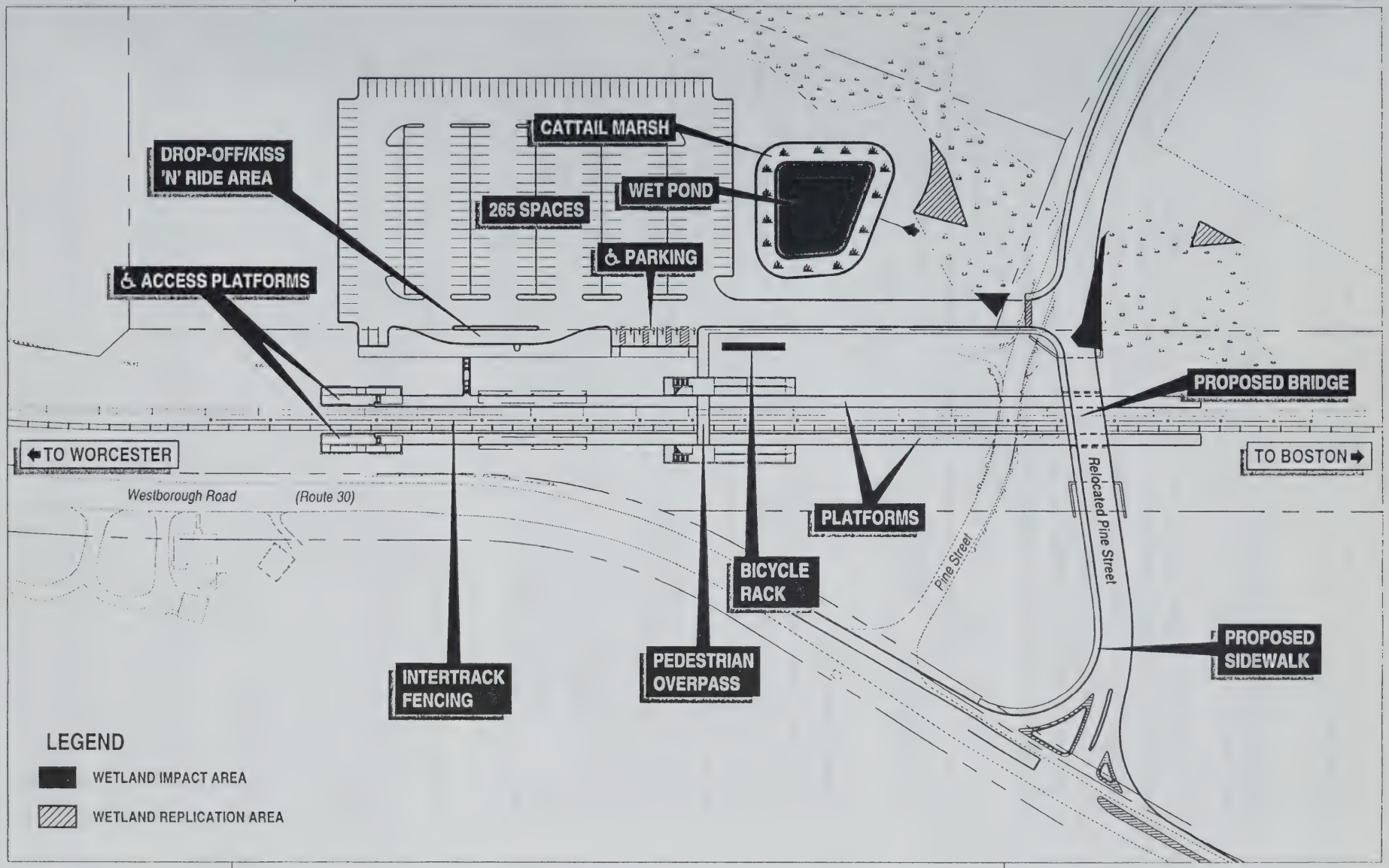
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

0 2000

LOCUS MAP
GRAFTON STATION

FIGURE 7.1-1



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 125'

0 125

SITE PLAN
GRAFTON, MA

FIGURE 7.1-2

Division of Capital Planning and Operations, and the station site was set aside for MBTA use. Transfer of ownership has been completed.

The station will provide parking for 265 vehicles, with a new access drive to be constructed to connect to Pine Street, just north of the railroad (Figure 7.1-2). The Station will include two 800-foot, low level boarding platforms; two 45-foot, long high-level access platforms for the disabled; an overhead pedestrian bridge with ramps and stairs, passenger drop-off area, station canopy, site lighting, landscaping, and bike racks. Intertrack fencing will be installed to discourage pedestrian crossing of the tracks.

The Grafton Station site currently has only a single track on the north side of the rail bed. This track will be refurbished, and a new second track installed, 14 feet on centers, on the southerly side of the railbed. This work, presently under construction, was described in the Track and Layover FEIR circulated for review in July 1995.

Adjacent Projects By Others

The Massachusetts Highway Department will be reconstructing the Pine Street bridge over the railroad as well as the Pine Street approaches and the intersection with Route 30 as part of the Department's ongoing substandard bridge replacement program. Design of the new bridge has allowed for the proposed station elements where necessary; for example, bridge piers are set back to accommodate passenger platforms under the bridge. The Pine Street bridge construction will begin in the spring of 1996.

The Worcester Business Development Corporation has been preparing conceptual design plans for an industrial park development on Pine Street northerly of the proposed MBTA Station. This project is intended to attract bio-tech business to the site, to be developed for a several year period. The CenTech Park project is undergoing MEPA review (EOEA No. 8798).

The traffic analyses performed for the Grafton Station include future growth resulting from the CenTech Park project. The proposed geometrics for the Pine Street/Route 30 intersection have been designed to accommodate both commuter rail and anticipated bio-tech park traffic.

7.2 Local Traffic

This section provides a summary of the complete traffic analysis included in the November 1994 DEIR Appendix, Volume I. This section summarizes existing traffic

conditions in Grafton, projected ridership for the Grafton Station, and the impact of that ridership on area streets and intersections.

The traffic analysis prepared for the Grafton Station focused on the streets and intersections identified in the Certificate of the Secretary of Environmental Affairs on the ENF. Figures 7.2-1 (A.M. Peak Hour) and 7.2-2 (P.M. Peak Hour) show the location of the streets and intersections that were analyzed as part of the study. Analysis of the streets and intersections was performed for the existing conditions and the "No Build" and "Build" conditions for the years 1996 and 2001. A level of service (LOS) was calculated for each street segment and intersection.

A discussion of the LOS rating system is presented in Section 1.1 of November 1994 DEIR Appendix, Volume I. A summary of the LOS designations is as follows:

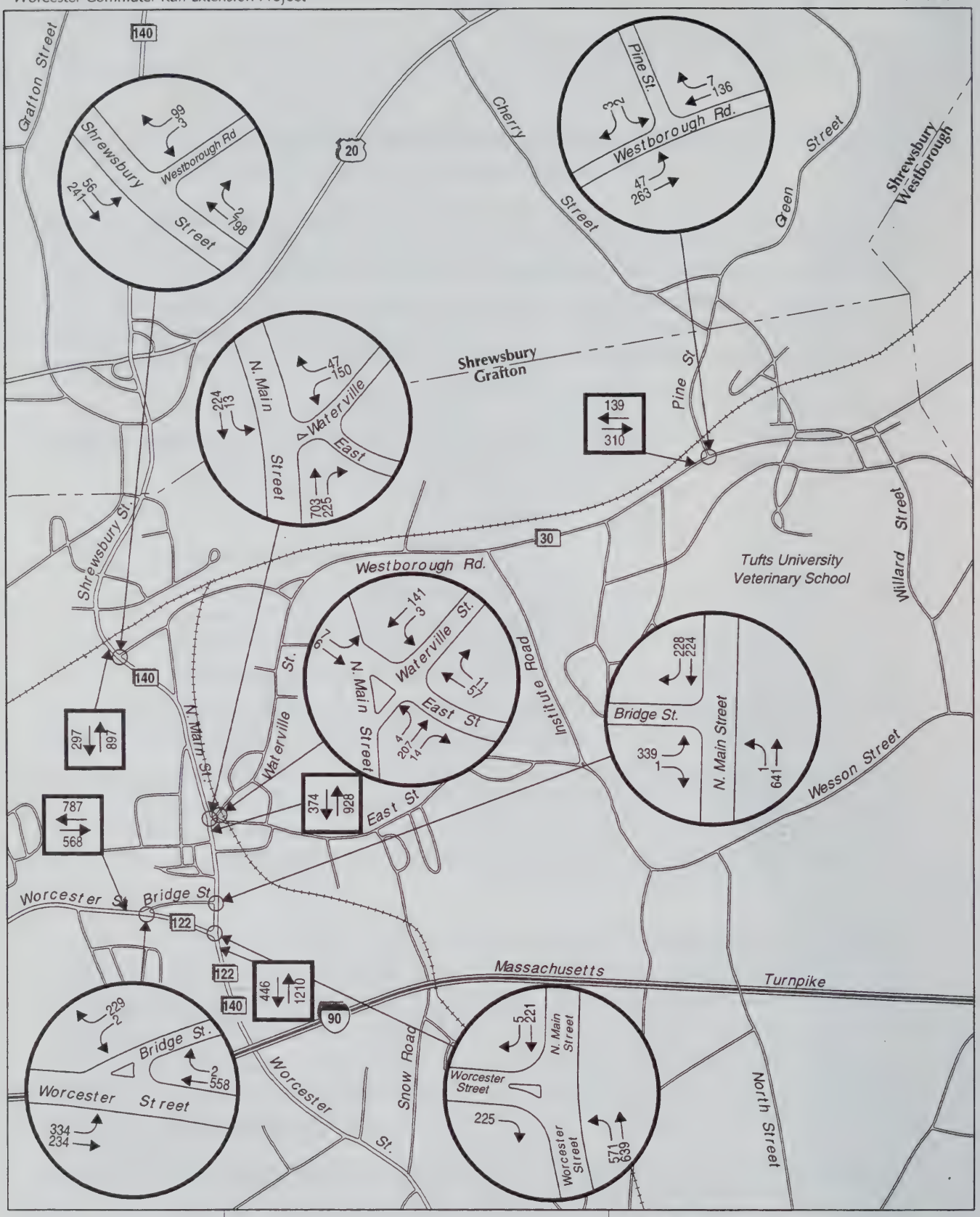
Rating	Judgment
A	Little or no delay
B	Short traffic delays
C	Average traffic delays
D	Longer than average delays
E	Very long traffic delays
F	Severe congestion, demand exceeds capacity

The results of the LOS analysis are presented for the A.M. and P.M. peak hours as well as the A.M. and P.M. peak generator hours. The A.M. and P.M. peak hours are those periods when traffic conditions are heaviest. The A.M. and P.M. peak generator hours are those periods when usage of the rail station is heaviest. Traffic count data showed that the A.M. and P.M. peak hours in Grafton are from 7:30 to 8:30 A.M. and 4:45 to 5:45 P.M., respectively. The A.M. and P.M. peak generator hours are from 6:45 to 7:45 A.M. and 5:45 to 6:45 P.M., respectively.

Existing Conditions

Existing conditions were determined by traffic counts and intersection turning movement counts conducted in the Fall of 1992 and the Spring of 1993. The results of the counts were used to calculate existing condition levels of service for each of the intersections and street segments studied. Figures 7.2-1 and 7.2-2 show existing A.M. and P.M. peak hour volumes within the study area. Figure 7.2-3 shows existing Average Daily Traffic (ADT) and Average Weekday Traffic (AWDT) on roadway segments within the study area.

Table 7.2-1 shows the unsignalized intersection levels of service and Table 7.2-2 shows the roadway segment levels of service.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

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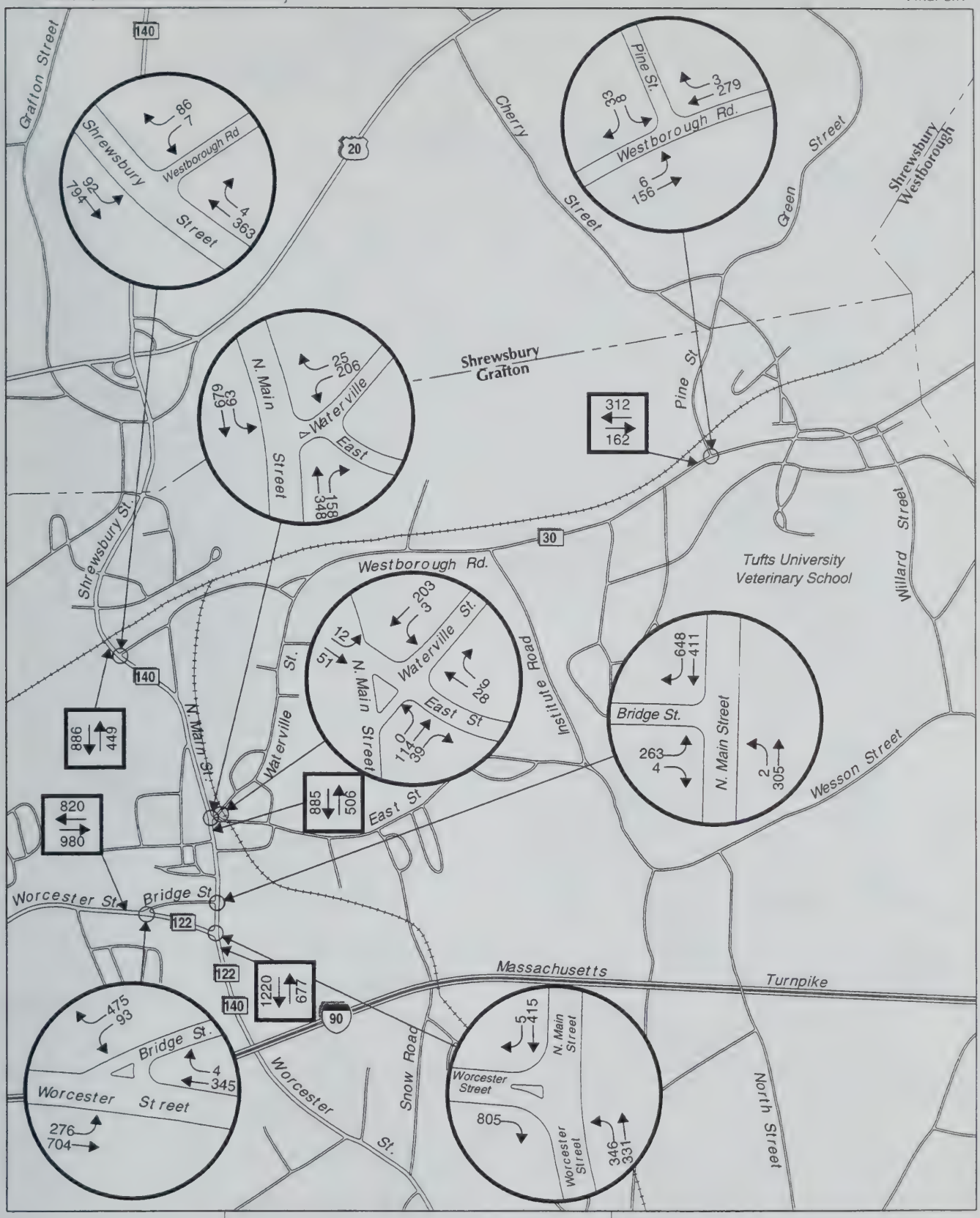
AM Peak Hour
7:30 - 8:30 A.M.
1992 Existing Conditions
GRAFTON STATION

FIGURE 7.2-1



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

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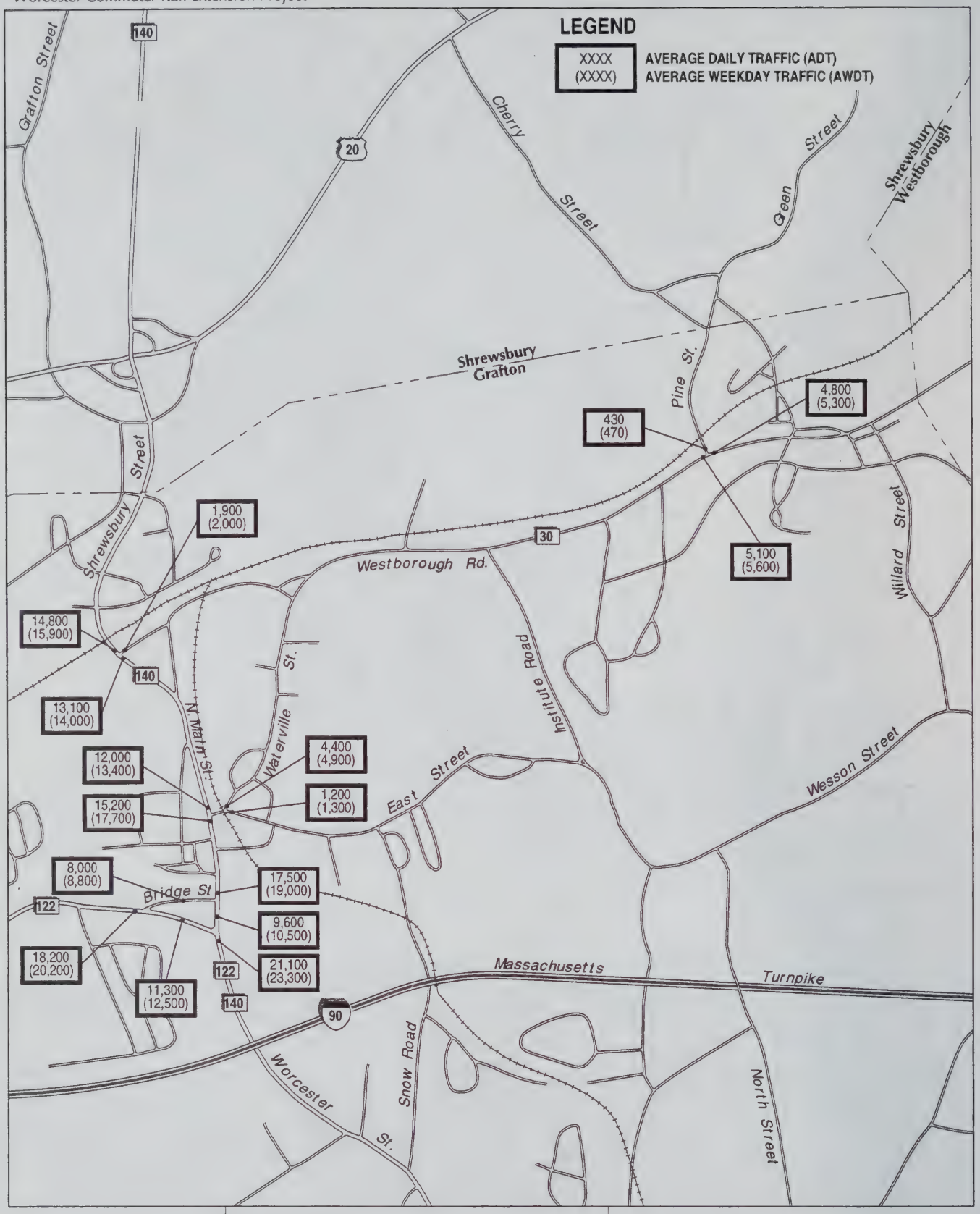
PM Peak Hour
4:45 - 5:45 P.M.
1992 Existing Conditions
GRAFTON STATION

FIGURE 7.2-2



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

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1992 Average Daily Traffic & 1992 Average Weekday Traffic
GRAFTON STATION

FIGURE 7.2-3

Table 7.2-1 1992 Existing Unsignalized Intersection LOS

Grafton	Peak Hour		Peak Generator Hour	
	A.M.	P.M.	A.M.	P.M.
Shrewsbury and Westborough				
LT from SB Shrewsbury	B	A	A	A
LT and RT from Westborough	D	C	C	A
North Main and Waterville				
LT from SB North Main	B	A	A	A
LT and RT from Waterville	F	F	D	E
Waterville and East				
LT from NB Waterville	A	A	A	A
LT from SB Waterville	A	A	A	A
THRU and RT from WB East	A	A	A	A
LT and THRU from EB East	A	A	A	A
North Main and Bridge				
LT from NB North Main	A	B	A	A
LT and RT from Bridge	F	F	F	F
Worcester and Bridge				
LT from SB Worcester	C	A	B	A
LT from Bridge	E	F	E	D
RT from Bridge	A	A	A	A
North Main and Worcester				
THRU from SB North Main	F	F	F	F
RT from SB North Main	B	A	B	A
Westborough and Pine				
LT from EB Westborough	A	A	A	A
LT and RT from Pine	A	A	A	A

Table 7.2-2 1992 Existing Road Segment LOS

Grafton	Peak Hour		Peak Generator Hour	
	A.M.	P.M.	A.M.	P.M.
Route 30 West of Pine Street	C	C	C	C
Route 140 North of Westborough	D	D	D	D
Route 140 South of Route 30	E	E	E	E
Route 122 West of Bridge	E	E	D	E
Route 122/140 South of Bridge Street	E	E	E	E

The Grafton Police Department was contacted on June 21, 1994 to ascertain the existence and location of high frequency accident locations and other safety concerns. Chief Messier indicated two intersections were of particular concern: the intersection of

Bridge Street at North Main Street, and the intersection of North Main Street at Worcester Street. Review of accident data supplied by the Police Department indicates that each of these intersections has an accident rate that is higher than the average for similar type intersections.

Rail Ridership Projections

Projections of rail ridership for each of the proposed new stations of the Worcester Commuter Rail Extension project were prepared by the Central Transportation Planning Staff (CTPS) in May 1994. The results of this planning analysis were included in the Draft EIR and Appendix Volume I, circulated for review in November 1994.

The Draft EIR presented 1996 traffic projections and analyses for two alternatives—the first assumed all five intermediate stations were built (the proposed project), and the second was a "worst case" that assumed only the Grafton Station would be built in 1996.

Ridership projections were updated by CTPS in January 1996 to address review comments on the DEIR, to evaluate regional station alternatives, and to develop ridership estimates for a scenario in which Millbury and Grafton were the only intermediate stations. The updated CTPS ridership projections are discussed in Section 4.3 and included in Appendix D of this FEIR.

Build All Stations

CTPS projected that in 1996, the Grafton Station would attract a total of 116 daily round-trip commuters. None of these patrons would walk to the station, and nine are projected to be dropped off. The remaining 107 patrons would drive to and park at the station. Based on a vehicle occupancy rate of 1.12, the 107 Park'n'Ride patrons would result in a demand for 96 parking spaces.

Under the build-all stations scenario, patrons of the Grafton Station are projected to originate in the towns of Grafton, Shrewsbury, Sutton, Boylston, and Northbridge. Table 7.2-3 shows the town of origin distribution.

Build Grafton and Millbury Only

The updated CTPS projections included analysis of a scenario in which Grafton and Millbury were the only intermediate stations operational in 1996. In this case, Grafton ridership would increase to 216 patrons. None of the patrons will walk to the station; 17 will be dropped off, and 199 will park at the station, creating a demand for 178 spaces. The distribution of ridership by town of origin is shown in Table 7.2-3.

Build Grafton Only

A "worst case" analysis presented in the DEIR included projections of ridership for a "Grafton only" alternative, in which case an estimated 444 persons per day would use the Grafton Station. Ridership would be attracted from the adjoining towns as well as several communities west of Grafton, as shown in Table 7.2-3.

Of the projected 444 riders, none would walk to the station; 32 would be dropped off; and 408 would park, creating a demand for 364 spaces.

Table 7.2-3 Town of Origin of Projected Ridership, Grafton Station-Year 1996

Town	All Stations	Grafton and Millbury Only	Grafton Only
Grafton	37	39	40
Shrewsbury	18	88	89
Sutton	16	17	17
Boylston	17	18	18
Northbridge	28	30	30
Upton		4	30
Westborough		7	18
Northborough		13	62
Oxford			20
Charlton			18
Millbury			29
Auburn			22
Worcester			51
Totals	116	216	444

Assignment of Riders to Trains

Commuter rail riders to the Grafton Station would arrive at the Pine Street Station to board one of four A.M. peak period trains and would leave the station in the P.M. peak period based on the five scheduled P.M. peak period trains. The distribution of riders to each train was determined by use of an equation based on observed arrival and departure data from several MBTA commuter rail lines. The observations of distribution by train show the greatest number of riders on the trains arriving at Boston close to 8:30 A.M. Trains arriving earlier and trains getting to Boston after 9:00 A.M. attract fewer riders. In the evening peak, the observations also show greater ridership in the middle of what is normally considered peak commuting period.

1996 Traffic Impacts - Build All Stations

"No Build" Traffic Volumes

To assess the traffic impacts of the "Build" alternative, the 1996 "No Build" is used as a point of reference. To obtain 1996 "No Build" traffic volumes, the 1992 existing volumes were increased to account for background growth in traffic. The rate of growth to be employed is usually determined by analyzing historical trend data at permanent traffic count stations. During the 1980s, traffic volumes typically increased at rates of 2-3 percent per year in many areas. Data from permanent traffic count locations in the Grafton area showed mixed results, including decreases in traffic volumes. As a conservative approach, 0.5 percent annual growth was used to derive 1996 "No Build" volumes from the 1992 existing conditions volumes.

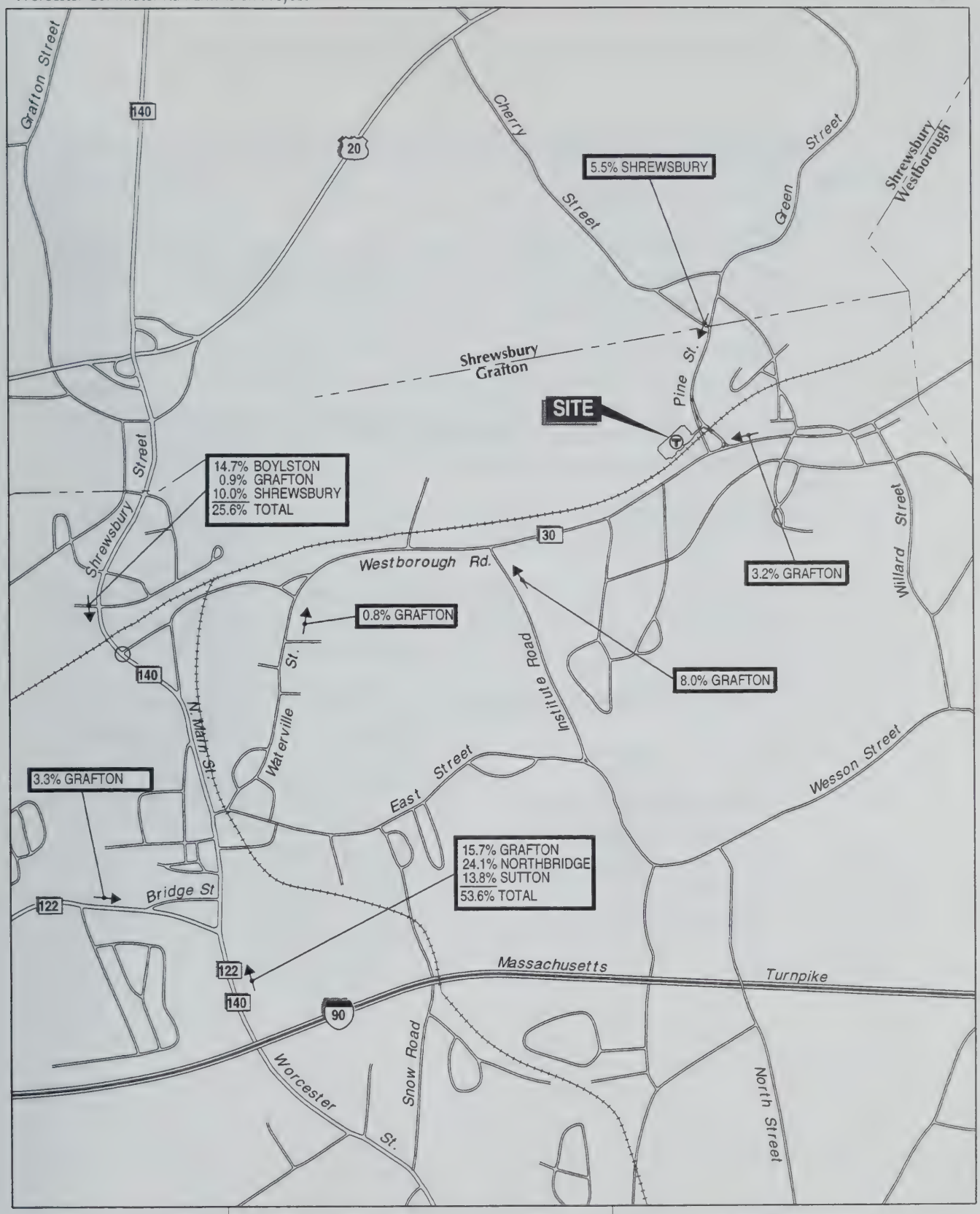
The only anticipated change to the study area roadway network will occur at the North Main Street/Waterville Street/East Street intersection. The Massachusetts Highway Department (MHD) proposes to install a new traffic signal at this intersection. It is expected that the new signal will be in operation by 1996. Therefore, the intersection was analyzed as a signalized intersection for the 1996 conditions.

"Build" Traffic Volumes

The "Build" alternative did not assume any redistribution of existing traffic on local roads. In other words, the commuters driving to the rail station were considered to be new trips. In actuality, many of those who would drive to the station are already on the road. Their trip will be shortened by driving to the station. In some cases, they are already driving on the same roads to access Route 9, for example, as they would to go to the new station. The "Build" analysis, therefore, does some double counting of vehicles and tends to be a worst case analysis.

To establish the "Build" traffic volumes, the commuter rail station traffic was assigned to particular routes in the study area based on the town of origin (as given in Table 7.2-3). Riders who live in Grafton would use a variety of travel routes, depending on the location of residence, with some emphasis on Route 122/Route 140 from the south.

The majority of station traffic from communities to the north would use Route 140 southbound to Westborough Road to Pine Street; an estimated 5 percent of this traffic would likely use Green Street in Shrewsbury. Traffic from Sutton and Northbridge would use northbound Route 122 to Route 140 to Waterville Street to Westborough Road to Pine Street. Figure 7.2-4 shows the projected distribution and percentage of station related traffic that would use the Grafton area roadways, for the "Build All Stations" ridership.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

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Distribution of Commuter Rail Station Traffic
1996 BUILD ALL STATIONS
GRAFTON STATION

FIGURE 7.2-4

The peak hour and peak generator hour overlap by 15 minutes in the A.M. period. There is no overlap in the P.M. peak period. Both peak hour and peak generator hour conditions were analyzed to determine the greatest impact to area roadways.

Tables 7.2-4 through 7.2-7 present the results of the LOS analysis for both the signalized and unsignalized intersections. The tables reflect "No Build" and "Build" conditions for the peak hours and peak generator hours.

As indicated in the tables no change in LOS is expected at either the signalized intersection or the unsignalized intersections due to traffic related to the commuter rail station. The signalized intersection will operate acceptably under both the "No Build" and "Build" conditions. The unsignalized intersection movements which operate at LOS F in the "No Build" condition will operate at LOS F in the "Build" condition.

Tables 7.2-8 and 7.2-9 show the LOS ratings for the road segments analyzed in conjunction with the proposed station.

As shown, the road segments generally operate at acceptable levels of service except for Route 140 north of Westborough Road which is projected to experience a reduction of LOS from D to E in the P.M. peak hour in 1996 "Build" condition.

Table 7.2-4 1996 Signalized Intersection LOS - A.M. Peak Hours (Build All Stations)

Grafton	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 140 and Route 30 and East	B	B	B	B
Eastbound, East Street	D	D	C	C
Westbound, Waterville Street	D	D	C	C
Northbound	B	B	B	B
Southbound	A	A	A	A

Table 7.2-5 1996 Signalized Intersection LOS - P.M. Peak Hours (Build All Stations)

Grafton	P.M. Peak Hour		P.M. Generator Peak Hour	
	No Build	Build	No Build	Build
Route 140 and Route 30 and East	B	B	B	B
Eastbound, East Street	C	C	B	B
Westbound, Waterville Street	C	C	B	C
Northbound	B	B	B	B
Southbound	C	B	B	B

Table 7.2-6 1996 Unsignalized Intersection LOS -A.M. Peak Hours (Build All Stations)

Grafton	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Shrewsbury and Westborough				
LT from SB Shrewsbury	B	B	A	A
LT and RT from Westborough	D	D	C	C
North Main and Bridge				
LT from NB North Main	A	A	A	A
LT and RT from Bridge	F	F	F	F
Worcester and Bridge				
LT from SB Worcester	C	C	B	B
LT from Bridge	E	E	E	E
RT from Bridge	A	A	A	A
North Main and Worcester				
THRU from SB North Main	F	F	F	F
RT from SB North Main	C	C	B	B
Westborough and Pine				
LT from EB Westborough	A	A	A	A
LT and RT from Pine	A	A	A	A

Table 7.2-7 1996 Unsignalized Intersection LOS - P.M. Peak Hours (Build All Stations)

Grafton	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Shrewsbury and Westborough				
LT from SB Shrewsbury	A	A	A	A
LT and RT from Westborough	C	C	A	A
North Main and Bridge				
LT from NB North Main	B	B	A	A
LT and RT from Bridge	F	F	F	F
Worcester and Bridge				
LT from SB Worcester	A	A	A	A
LT from Bridge	F	F	D	D
RT from Bridge	B	B	A	A
North Main and Worcester				
THRU from SB North Main	F	F	F	F
RT from SB North Main	A	A	A	A
Westborough and Pine				
LT from EB Westborough	A	A	A	A
LT and RT from Pine	A	A	A	A

Table 7.2-8 1996 Road Segment LOS - A.M. Peak Hours (Build All Stations)

Grafton	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 30 West of Pine	C	C	C	C
Route 140 North of Westborough	D	D	D	D
Route 140 South of Route 30	E	E	E	E
Route 122 West of Bridge	E	D	E	E
Route 122/140 South of Bridge Street	E	E	E	E

Table 7.2-9 1996 Road Segment LOS - P.M. Peak Hours (Build All Stations)

Grafton	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 30 West of Pine	C	C	C	C
Route 140 North of Westborough	D	E	D	D
Route 140 South of Route 30	E	E	E	E
Route 122 West of Bridge	E	E	E	E
Route 122/140 South of Bridge Street	E	E	E	E

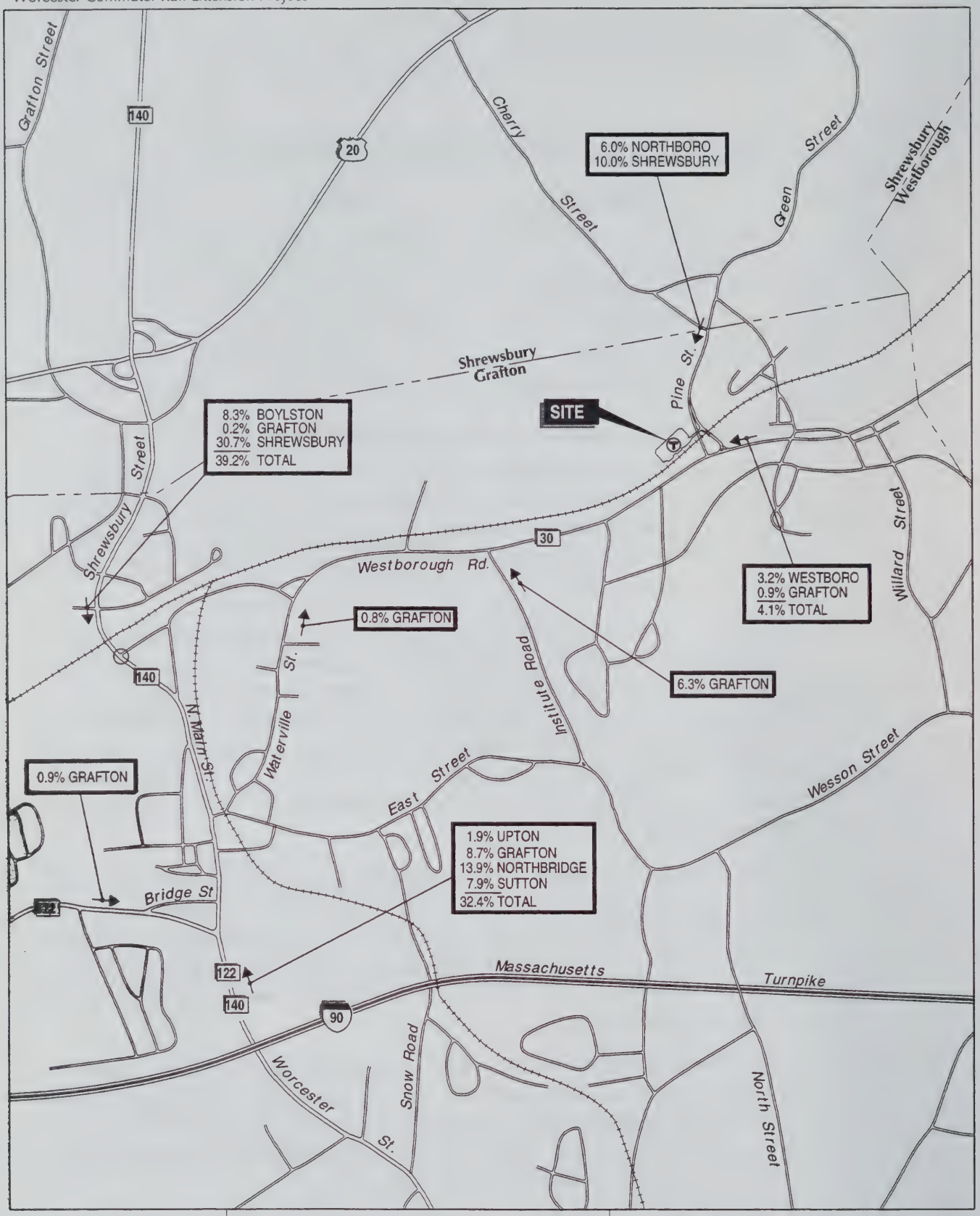
1996 Traffic Impacts - Millbury and Grafton Stations Only

The Draft EIR presented traffic projections and analyses for 1996 for two alternatives. The first assumed all intermediate stations were built (the proposed project), and the second was a "worst case" that assumed only the Grafton Station was built by 1996. The current plan is that only Millbury and Grafton will be operational in 1996 (in addition to the present Worcester Station).

During the interim when Millbury and Grafton are the only intermediate stations in service, Grafton will attract a projected 216 riders each workday in 1996, an increase of 100 over the "Build All Stations" scenario ridership of 116. The majority of these additional patrons will be from the communities of Shrewsbury (70) and Northborough (13). Station patrons from Shrewsbury and Northborough were assumed to reach the Grafton Station primarily via Route 140 (Shrewsbury Street) and Westborough Road. Figure 7.2-5 shows the distribution of commuter rail station traffic for 1996 Build Millbury and Grafton Only.

Traffic analyses performed previously for the DEIR showed that Grafton Station, even under the worst case, would not result in significant impacts on level of service for any of the analyzed intersections or roadway segments. During the interim when Grafton and Millbury are the only stations, traffic at the Route 140 - Westborough Road intersection will be slightly higher than the "Build All Stations" scenario. However, the LOS will not be impacted significantly.

The additional patrons would add to the left turning volume from Route 140 southbound to Westborough Road eastbound in the morning peak hours; however, the reserve capacity of the unsignalized intersection is large enough to accommodate the (temporary) increase in turning volumes without a reduction from the level of service previously calculated for the 1996 "Build All Stations" scenario.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

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Distribution of Commuter Rail Station Traffic
1996 Build-Millbury & Grafton Only
GRAFTON STATION

FIGURE 7.2-5

1996 Traffic Impacts - Grafton Station Only

To address an upper limit, worst case situation with regard to traffic impacts on Grafton Streets, an analysis was performed which considered that Grafton was the only commuter station built by 1996 (in addition to a Worcester Station).

CTPS projected that, under this scenario, the Grafton Station would attract 444 daily round trip patrons, 408 of which would be Park'n'Riders. Site traffic was distributed over the roadway network in a manner similar to that described under 1996 "Build All Stations." The projected distribution is shown in Figure 7.2-6.

A LOS analysis was performed for the peak hour and peak generator hour "Build" condition. The "No Build" condition is the same as previously presented for the "Build All Stations" scenario.

Table 7.2-10 through 7.2-13 present the results of the LOS analysis for the signalized and unsignalized intersections.

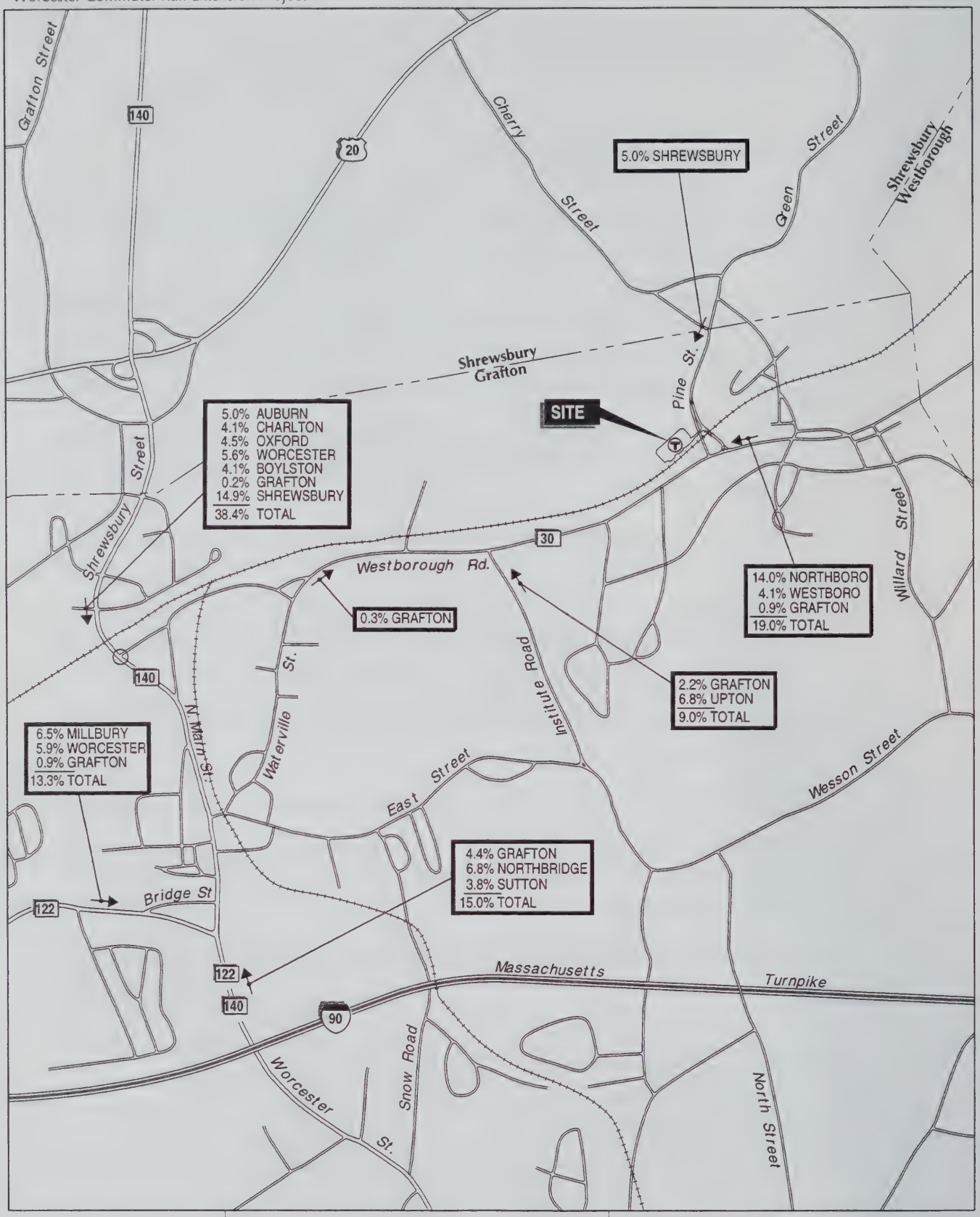
The signalized intersection operates at an acceptable level of service under both the "No Build" and "Build" condition with only a minor reduction in LOS in the P.M. peak hour. Several unsignalized intersection movements experience minor reductions in LOS in the "Build" condition. These movements continue to operate acceptably. The movements that function at LOS F in the "No Build" condition continue at LOS F in the "Build" condition.

Table 7.2-14 and 7.2-15 show the results of the LOS analysis for the roadway segments.

Generally, the road segments function at acceptable levels of service. Minor reductions in level of service occur on two segments in the "Build" condition. However, these segments continue to operate acceptably.

Table 7.2-10 1996 Signalized Intersection LOS - A.M. Peak Hours (Grafton Station Only)

Grafton	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 140 and Route 30 and East	B	B	B	B
Eastbound, East Street	D	D	C	C
Westbound, Waterville Street	D	D	C	C
Northbound	B	B	B	B
Southbound	A	A	A	A



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1750'

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Distribution of Commuter Rail Station Traffic
1996 BUILD GRAFTON ONLY
GRAFTON STATION

FIGURE 7.2-6

Table 7.2-11 1996 Signalized Intersection LOS - P.M. Peak Hours (Grafton Station Only)

Grafton	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 140 and Route 30 and East	B	C	B	B
Eastbound, East Street	C	C	B	B
Westbound, Waterville Street	C	D	C	D
Northbound	B	B	B	B
Southbound	C	C	B	B

Table 7.2-12 1996 Peak Hour Unsignalized Intersection LOS - A.M. Peak Hours (Grafton Station Only)

Grafton	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Shrewsbury and Westborough				
LT from SB Shrewsbury	B	C	A	B
LT and RT from Westborough	D	D	C	C
North Main and Bridge				
LT from NB North Main	A	A	A	A
LT and RT from Bridge	F	F	F	F
Worcester and Bridge				
LT from SB Worcester	C	C	B	C
LT from Bridge	E	E	E	E
RT from Bridge	A	A	A	A
North Main and Worcester				
THRU from SB North Main	F	F	F	F
RT from SB North Main	C	C	B	B
Westborough and Pine				
LT from EB Westborough	A	A	A	A
LT and RT from Pine	A	A	A	A

Table 7.2-13 1996 Peak Hour Unsignalized Intersection LOS - P.M. Peak Hours (Grafton Station Only)

Grafton	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Shrewsbury and Westborough				
LT from SB Shrewsbury	A	A	A	A
LT and RT from Westborough	C	C	A	B
North Main and Bridge				
LT from NB North Main	B	B	A	A
LT and RT from Bridge	F	F	F	F
Worcester and Bridge				
LT from SB Worcester	A	A	A	A
LT from Bridge	F	F	D	D
RT from Bridge	B	B	A	A
North Main and Worcester				
THRU from SB North Main	F	F	F	F
RT from SB North Main	A	A	A	A
Westborough and Pine				
LT from EB Westborough	A	A	A	A
LT and RT from Pine	A	A	A	A

Table 7.2-14 1996 Road Segment LOS - A.M. Peak Hours (Grafton Station Only)

Grafton	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 30 West of Pine	C	D	C	D
Route 140 North of Westborough	D	E	D	D
Route 140 South of Route 30	E	E	E	E
Route 122 West of Bridge	E	D	D	D
Route 122/140 South of Bridge Street	E	E	E	E

Table 7.2-15 1996 Road Segment LOS - P.M. Peak Hours (Grafton Station Only)

Grafton	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 30 West of Pine	C	C	C	C
Route 140 North of Westborough	D	E	D	D
Route 140 South of Route 30	E	E	E	E
Route 122 West of Bridge	E	E	E	E
Route 122/140 South of Bridge Street	E	E	E	E

2001 Traffic Impacts, All Stations

In addition to a small increase in commuter traffic between years 1996 to 2001 at the Grafton Station, background traffic growth was added at a rate of 1.5% per year. A future positive growth adjustment was made to allow for Phase I elements of Tuft's University and the Worcester Business Development Corporation BioTech centers, planned for the south side of Route 30 and the west side of Pine Street, respectively.

CTPS Report for Worcester Commuter Rail Extension Project, dated October 1995, projected that the Grafton Station is expected to attract 126 daily round trip commuters in 2001. Ten will be dropped off at the station and 116 will be Park'n'Riders. Distribution of traffic is essentially the same as shown in Figure 7.2-4.

A LOS analysis was conducted for the "No Build" and "Build" condition in both the peak hours and the peak generator hours.

The results of the LOS analysis for the signalized and unsignalized intersections are shown in Tables 7.2-16 through 7.2-19.

The signalized intersection will operate at an acceptable LOS under both the "No Build" and "Build" conditions; although the approach to East Street eastbound will function at LOS F in the P.M. peak hour in "No Build" and "Build." The majority of the unsignalized intersection movements operate at acceptable levels of service under both the "No Build" and "Build" conditions. The movements operating at LOS F in the "No Build" condition will operate at LOS F in the "Build" condition. Only one movement will experience a minor reduction in LOS.

Tables 7.2-20 and 7.2-21 present the results of the road segment LOS analysis.

As shown, no change in LOS will occur for the road segments between the "No Build" and "Build" conditions. The "Build" condition will result in some reduction in reserve capacity.

Table 7.2-16 2001 Signalized Intersection LOS - A.M. Peak Hours

Grafton	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 140 and Route 30 and East	C	C	B	B
Eastbound, East Street	E	E	C	C
Westbound, Waterville Street	D	D	C	C
Northbound	B	B	B	B
Southbound	B	B	A	A

Table 7.2-17 2001 Signalized Intersection LOS - P.M. Peak Hours

Grafton	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 140 and Route 30 and East	D	D	B	B
Eastbound, East Street	F	F	B	C
Westbound, Waterville Street	E	E	C	C
Northbound	B	B	B	B
Southbound	D	D	B	B

Table 7.2-18 2001 Unsignalized Intersection LOS - A.M. Peak Hours

Grafton	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Shrewsbury and Westborough				
LT from SB Shrewsbury	C	D	B	B
LT and RT from Westborough	E	E	C	C
North Main and Bridge				
LT from NB North Main	A	A	A	A
LT and RT from Bridge	F	F	F	F
Worcester and Bridge				
LT from SB Worcester	D	D	C	C
LT from Bridge	E	E	E	E
RT from Bridge	B	B	A	A
North Main and Worcester				
THRU from SB North Main	F	F	F	F
RT from SB North Main	C	C	B	B
Westborough and Pine				
LT from EB Westborough	A	A	A	A
LT and RT from Pine	A	A	A	A

Table 7.2-19 2001 Unsignalized Intersection LOS - P.M. Peak Hours

Grafton	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Shrewsbury and Westborough				
LT from SB Shrewsbury	A	A	A	A
LT and RT from Westborough	D	D	B	B
North Main and Bridge				
LT from NB North Main	C	C	A	B
LT and RT from Bridge	F	F	F	F
Worcester and Bridge				
LT from SB Worcester	A	A	A	A
LT from Bridge	F	F	E	E
RT from Bridge	C	C	A	A
North Main and Worcester				
THRU from SB North Main	F	F	F	F
RT from SB North Main	A	A	A	A
Westborough and Pine				
LT from EB Westborough	A	A	A	A
LT and RT from Pine	A	A	A	A

Table 7.2-20 2001 Road Segment LOS - A.M. Peak Hours

Grafton	A.M. Peak Hour		A.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 30 West of Pine	D	D	C	C
Route 140 North of Westborough	E	E	D	D
Route 140 South of Route 30	E	E	E	E
Route 122 West of Bridge	E	E	E	E
Route 122/140 South of Bridge Street	E	E	E	E

Table 7.2-21 2001 Road Segment LOS - P.M. Peak Hours

Grafton	P.M. Peak Hour		P.M. Peak Generator Hour	
	No Build	Build	No Build	Build
Route 30 West of Pine	D	D	C	C
Route 140 North of Westborough	E	E	D	D
Route 140 South of Route 30	E	E	E	E
Route 122 West of Bridge	E	E	E	E
Route 122/140 South of Bridge Street	E	E	E	E

Summary of Findings

The traffic analysis shows that generally the streets and intersections studied in Grafton currently operate at acceptable levels. The exceptions are for traffic turning from Waterville Street (Route 30) to North Main Street (Route 140), traffic turning from Bridge Street to North Main Street (Route 140) and for southbound through traffic on Route 140 south of Bridge Street. The installation of a proposed traffic signal by the Massachusetts Highway Department at the Waterville Street/North Main Street intersection should improve traffic flow at this location. The MHD anticipates that installation of the traffic signal will be completed prior to opening of the commuter rail station.

The analysis indicates that the addition of traffic volumes attributable to the proposed Grafton Station will not result in any significant adverse impacts on the roadways considered in this report. For both years 1996 and 2001, the analysis shows no significant change in levels of service for the signalized and unsignalized intersections and the roadway segments. The same applies to 1996 Millbury/Grafton Only, where impacts are insignificant.

Review of preliminary accident data reveals higher than expected accident rates at the North Main Street/Bridge Street intersection and the North Main Street/Worcester Street intersection. The small volumes of station traffic added to these intersections are not expected to contribute to increased accidents.

7.3 Air Quality

Employing the rationale and methodology described for the Millbury Station analysis, the intersection of Route 140 (North Main Street) and Route 30 (Waterville Street) and East Street was selected for analysis (see Figure 7.1-1).

Although the intersection is presently unsignalized, a traffic signal will be installed in 1996 by the Massachusetts Highway Department. All traffic analyses for the year 1996 were performed with the signal in place. The intersection exhibits the traffic volumes and queued traffic which was determined to produce the highest CO concentrations.

In order to produce the highest CO concentrations, receptor locations were established along the sidewalk areas nearest to the traffic lanes. On the southerly side of the intersection, the sidewalks evaluated are on the west across from the variety store and on the east in front of the store. On the northerly side of the intersection, the sidewalk in front of the service garage was evaluated. The results for the year 1996 are as follows in Table 7.3-1.

Table 7.3-1 1996 CO Concentrations - Route 140/Route30/East Street Intersection, Grafton

	1-Hour CO (ppm)		8-Hour CO (ppm)	
	No Build	Build	No Build	Build
Southwest Sidewalk	5.0	5.1	3.5	3.6
Southeast Sidewalk	5.9	6.0	4.1	4.2
Northeast Sidewalk	7.9	7.9	5.5	5.5

The predicted CO concentrations are the same or nearly the same for the "No Build" and "Build" conditions, for both the 1-hour and 8-hour periods. All values are well below the 35 ppm for the 1-hour standard and 9 ppm for the 8-hour standard. Additional receptors evaluated included 4 single-family residences, the variety store/apartment building and the service garage. The predicted CO concentrations for the 1-hour case range from 3.7 ppm for "No Build" to 5.1 ppm for the "Build" condition. Similarly the 8-hour values range from 2.6 ppm to 3.6 ppm. Most predicted concentrations are the same or only slightly higher for "Build" versus "No Build". There are no other Grafton intersections affected by station generated traffic that would exhibit higher CO concentrations.

7.4 Noise and Vibration

Noise Impact Analysis Methodology

Because of slow train speeds near stations, the potential for noise and vibration impacts from train operations are at a minimum compared to other segments of the right-of-way. There is, however, the potential of effects on the noise and vibration environment in the vicinity of the station because of project-induced traffic on roads leading to and from station areas, as well as short-term effects during construction of platforms, parking and other site facilities.

Traffic Noise

The significance of noise impacts from project-generated traffic near proposed commuter rail stations along the corridor was assessed based on the projected noise increase relative to the noise from existing traffic on applicable roads. Because the greatest changes in traffic volumes are expected to occur during peak commuting periods, the noise increase was evaluated in terms of the peak-hour L_{eq}.

Criteria for traffic noise impact are based on existing FTA guidelines, and state that a noise level increase of greater than 5 dBA is considered to represent impact. The existing FTA criteria are used here rather than the proposed FTA criteria used in the train noise assessment because of the general, non-site specific nature of the traffic noise impact assessment. Where the existing layout of major roads will essentially remain the same, the traffic noise assessment predicts only the change in noise resulting from the projected change in traffic volumes near the stations, and not the absolute traffic noise levels at specific noise-sensitive locations in the community.

The traffic noise analysis was carried out on a relative basis, by estimating the change in peak-hour traffic noise, which is a function of the change in peak-hour traffic volume. The assumption is that all other non-project related noise sources remain unchanged.

Construction Noise and Vibration

Construction of the commuter rail station is expected to include clearing, excavation, foundation work, equipment installation, paving and finishing. Construction machinery is likely to include the types of equipment typically used for light industrial construction, such as graders, bulldozers, backhoes, cranes and trucks. Construction will typically occur during 8 to 10 hour weekday, daytime periods.

Construction of the station can be categorized in two distinct operations—parking lots and platform areas—with total duration of construction estimated to be approximately eight months.

For a typical station site, the distance to significant noise impact was estimated to be 200-feet measured from the closest area of construction. In cases where noise-sensitive land uses were concentrated in a location very close to either the platform area or the parking area, separate screening distances were used to assess the two construction scenarios.

Station construction noise exposure was estimated using equipment noise levels and scenarios that are typical for non-residential construction (EPA, 1971). Usage factors were assigned to each piece of equipment to determine a cumulative reference noise level to use in determining the width of the noise impact zone.

Noise impact criteria for construction are based on the outdoor Annual Average Day-Night Equivalent Sound Level (AA L_{dn}), with a threshold of 65 AA L_{dn} defining the impact zone. This metric is slightly less conservative than the 24-hour L_{dn} used for train noise impact, given the short-term nature of construction noise impact. (A complete definition of metrics and terms pertaining to noise and vibration used in this report are given in the Draft EIR Appendix 3).

The impact criteria for construction vibration are essentially the same as for train operations, except that impact is assessed only when the activity will occur for 30 days or more at a given location. Ground-borne vibration from construction was estimated based on equipment source data found in literature. Vibration projections were made for the main equipment categories, based on the relative amount of energy imparted to the ground. A screening distance of 85 ft measured from nearest area of construction was estimated for vibration impact from general construction activity at stations.

Traffic Noise Impacts

For Grafton Station, there are two residences to the west of the station site, located 30 ft and 70 ft, respectively, south of the centerline of Westborough Road (Route 30). Other surrounding land use includes the Tufts University School of Veterinary Medicine, also located south of Route 30.

No additional roads are proposed to be built to access the station; therefore, a relative increase in traffic noise is sufficient for evaluating noise impact. The peak-hour traffic volume on Route 30 is projected to increase by a factor of 1.1, resulting in a less than 1 dBA increase in peak-hour L_{eq}. Hence, no noise impact is projected for noise-sensitive buildings near the Grafton Station site.

Construction Noise and Vibration Impacts

One home on Westborough Road is projected to be exposed to both short-term noise and vibration impact from station construction. At the Grafton site, rock excavation will be required to construct the station platform and pedestrian bridge on the south side of the railroad.

For reasons of safety, rock excavation by blasting will not be allowed adjacent to active railroad tracks. Any rock excavation for construction of the station will be done by use of mechanical devices.

Traffic Noise Mitigation

No significant traffic noise impact was identified for the Grafton station.

Construction Noise and Vibration Mitigation

As described in previous text, no significant impacts were identified from construction activities for Grafton Station. No site-specific mitigation plan is necessary.

Section 1.07 of the Standard Specifications used by the MBTA for construction contracts include noise control measures as follows:

"Use every effort and every means possible to minimize noises caused by construction operations, which the Engineer may consider as objectionable. Provide working machinery and equipment designed to operate with the least possible noise, and when gearing is used, such gearing shall be of a type designed to reduce noise to a minimum. Equip compressors with silencers on intake lines. Equip gas or oil operated equipment with silencers or mufflers on intake and exhaust lines. Wherever practicable, electricity shall be used for power to reduce noise. Dumping bins, hoppers, and trucks used for disposal of excavated materials shall be lined with wood or other sound-deadening material if required. Where required by agencies having jurisdiction, certain noise-producing work may have to be performed during specified periods only."

No construction related vibration impact was identified for Grafton Station and no mitigation is required.

7.5 Wetlands and Drainage

The proposed Grafton Station Site lies within the Blackstone River watershed. The area currently consists of both open meadow and wooded area. Subsurface soils include well drained fine sandy loam. Rock outcrops and boulders are evident throughout the site.

The majority of the site drains in a northerly and easterly direction, to the adjacent wetland system. Stormwater then flows in an easterly direction under Pine Street, then in a southerly direction under the railroad tracks and under Westborough Road (Route 30) where it connects to Axtell Brook. Axtell Brook flows in a southerly direction to Lake Ripple and connects to Quinsigamond River at a point approximately two miles south of Route 30. Quinsigamond River also flows in a southerly direction into Fisherville Pond for an additional two miles before discharging into the Blackstone River.

The proposed commuter rail station will include 265 paved parking spaces, ramps, stairs, train platforms, landscaping and associated stormdrain systems. A 250-foot long driveway will connect the station to Pine Street. Along the northerly side of the driveway from Pine

Street, 850 s.f. of wetland will be displaced. Immediately adjacent replication will be accomplished by the construction of 1,300 s.f. of new wetland.

The project will implement Best Management Practices (BMPs) in order to minimize and mitigate any stormwater related impacts created by the proposed project. BMPs will include a parking lot sweeping program and catch basins equipped with sumps and oil & grease traps. One objective of a sweeping maintenance program is to remove as many contaminants as possible from the parking lot surfaces before they are washed into the stormwater collection system. Studies have determined that a large percentage of contaminant loads are bound to particulates (silt and sand particles) and thus a regular sweeping program will be effective in reducing pollutant loadings and improving runoff water quality. Cleaning of catch basins will remove additional coarse sediment and large debris from the stormdrain system. In addition to reducing sediment loads, catch basins cleaning will also reduce the load of oxygen-demanding substances which could reach downstream surface waters. General maintenance of the station will also include removal of trash and organic debris (leaves, branches, etc.). This will reduce not only loadings of nutrient related contaminants, but also will help to keep the stormdrain system clear and working properly.

Sodium chloride (salt) is typically the main chemical used for de-icing roads, sidewalks and parking lots. Alternatives to salt will be considered and discussed with the Town during the advanced stages of design.

The proposed stormwater management system for the station includes a stormwater detention pond to mitigate any increase in peak flow rates generated by the station. The detention pond will be sized to accommodate stormwater runoff generated by storms up to and including the 100 year event. An outlet control structure will be designed to release stormwater at a controlled rate which will not exceed existing conditions for both the 10 and 100 year events. Table 7.5-1 indicates the estimated peak stormwater flow rates for the station site under existing and proposed conditions. The table shows that the peak flows will not exceed existing conditions. The supporting watershed mapping and TR-55 analysis with computer modeled hydrographs were included in the Draft EIR Appendix - Volume II, Section 5.

Table 7.5-1 Peak Runoff Rates Grafton Station

Storm Event	Existing Conditions	Proposed Conditions
10 Year	4.9 cfs	3.7 cfs
100 Year	10.0 cfs	5.6 cfs

The peak runoff rates and time of concentration values were utilized in a TR-20 computer modeled hydrograph program. The resultant peak discharge rates closely resembled those

generated with the TR-55 method. The graphical hydrographs provide a convenient method to analyze pre and post construction rates of runoff. The benefit of providing the detention basin becomes apparent when evaluating the lag period between inflow and outflow peak rates. Not only has the peak rate been reduced, but also the time of concentration has been increased by approximately 23 minutes. This allows more contact time within the detention basin which enhances water quality.

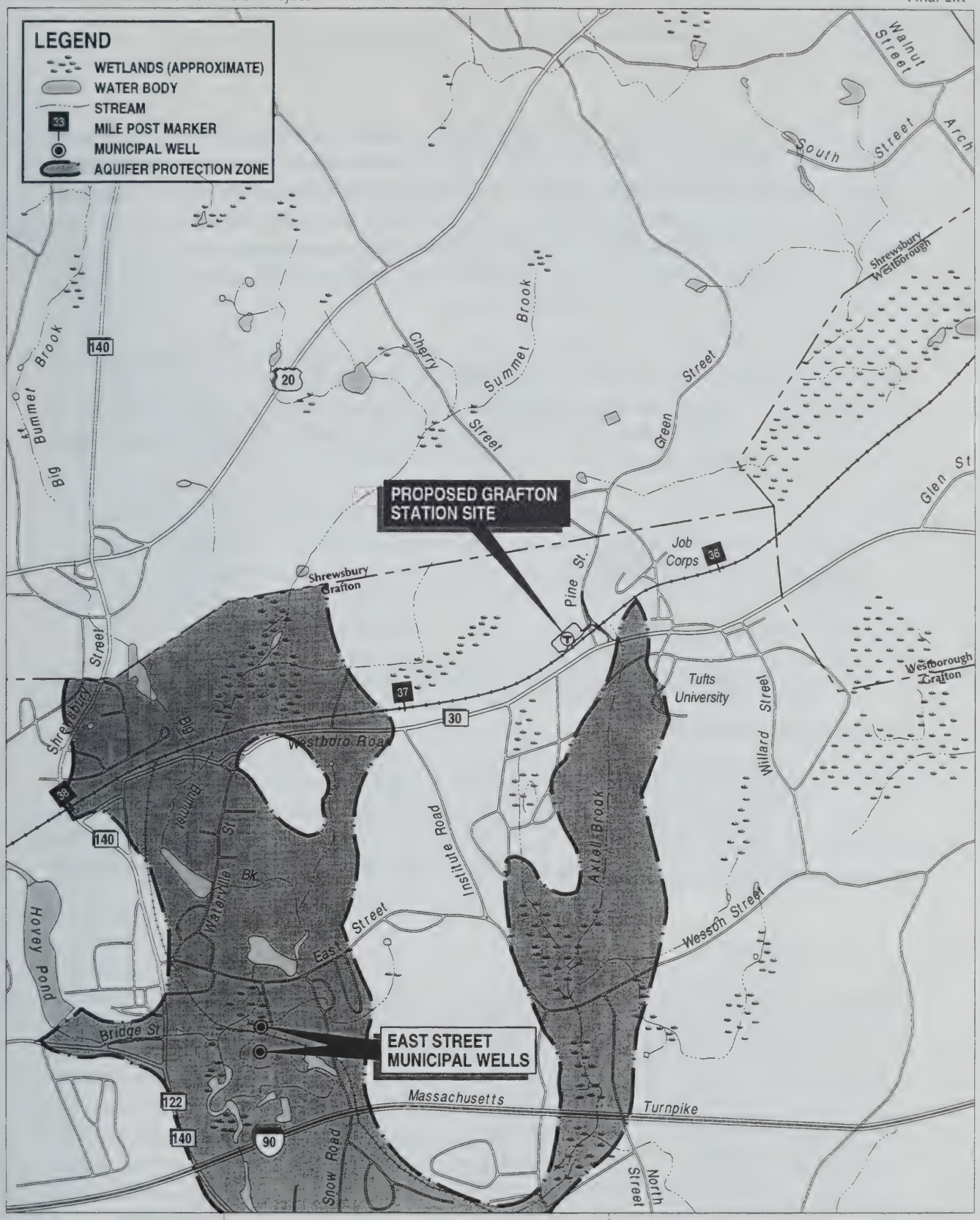
The proposed detention pond will include a permanent wet pond approximately 0.1 acre in area and 4-feet deep. The wetpond area will be planted to support a cattail marsh, one of the most effective means of treating urban runoff. Detention basins achieve pollution attenuation primarily by settling out particulates and their associated contaminants. Detention ponds which support wetland vegetation are also very effective in removing dissolved contaminants such as nitrogen and phosphorous. At the proposed Grafton station, stormwater runoff from the paved areas will displace treated water in the wet pond that has flowed through the cattail marsh before discharging to the existing wetlands.

Water Supply

The Town has public groundwater wells located on East Street and Worcester Street, south-southwest of the station site. The aquifer protection overlay zone, shown on Figure 7.5-1, includes the East Street wells and extends to an area just east of the station site but does not include the station site. Stormwater runoff from the station will be detained on site as part of the Best Management Practices (BMPs) described above. The Worcester Street well, and Lake Ripple located along Axtell Brook more than a mile from the proposed station, are not expected to be impacted by Grafton Station construction.

7.6 Historic Structures

The entrance to the proposed site of the MBTA rail station at Grafton is located within the campus of the former Grafton State Hospital, listed on the National Registered of Historic Places. The buildings and grounds, including the wooded and agricultural landscape, of the former state hospital campus are contributing features to the National Register District. Three former hospital buildings are visible form the Pine Street entrance to the train station. There are two other survey properties on the south side of Route 30, plus the Pine Street bridge, immediately adjacent to the train station.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

0 2000

WATER SUPPLY PROTECTION OVERLAY DISTRICT TOWN OF GRAFTON, MA

FIGURE 7.5-1

The potential impacts from the proposed station are primarily visual. A pedestrian overpass to be built over the track between the two sides of the platform will be partially visible from the streets and from the National Register District. The platform for the train station is below the level of Pine Street and Westborough Road and therefore the visual impacts of the platform are expected only from the proposed parking area. Portions of the station parking will also be visible from Pine Street and Westborough Road, somewhat dependent on seasonal vegetative cover.

The proposed use of landscaping will screen the parking area and minimize the visual effects to the National Register District. The design of the station will be sympathetic to the adjacent historic properties and not interfere with their historic setting. This can be accomplished through the use of materials and design that maintain the visual integrity of the area.

7.7 Archaeological Resources

Physical Environment

The proposed Grafton station is located northwest of Westborough Road (Route 30) and the railroad, and west of Pine Street . A small wetland is present between the project area and Pine Street.

The eastern half of the project area consists of a grassy area that is gently undulating; the western portion of the project area is a mixed deciduous and pine forest . There are numerous boulders scattered throughout the wooded portion of the project area. The presence of borrow pits in this section suggests that the area has been utilized for the removal of soil and boulders.

Methods

Two test blocks, each measuring 50 m. x 50 m. and containing 22 test pits arranged in a checkerboard pattern at 10-m. intervals, were laid out at the Grafton station location. The blocks were situated so that Block 1 tested the grassy area, Block 2 the wooded area. Test pits were excavated by shovel into glacial till or sand. The sediments from the individual levels of each pit were dry-screened through quarter-inch wire mesh; the cultural contents of each natural level were recorded and stored separately. The location, stratigraphy and cultural contents were recorded for each test pit on standard forms. Recovered artifacts were placed in plastic bags, together with provenience information (transect and pit number, stratigraphic level, and date), for processing and analysis.

At the laboratory, the recovered artifacts were cleaned, identified, and described. Description of artifacts encompassed (where appropriate) material, style, manufacturing technique, date, and behavioral implication; this information was entered and stored in a computer cataloguing system. This descriptive analysis was used to form the basis for recommendations about the need for additional field investigation. After analysis, artifacts were placed in plastic bags for curation.

Results

Through a combination of the excavation of cores and test pits, it was determined that a fill deposit was present throughout the area covered by Block 1. This fill consisted of a mottling of organic and subsoil deposits and contained twentieth-century artifacts such as bottle glass and whiteware. The single prehistoric artifact that was recovered at the site, an argillite small stemmed point preform, was also recovered from this deposit. Due to the presence of the fill, the number of test pits excavated in the block was reduced from 22 to 16. The excavation of these units as well as those in Block 2, indicated that the extent of the fill closely correlated with the limits of the vegetation, suggesting that the area was modified when it was cleared. The presence of an organic deposit that extended to depths as great as 50 cm. and that was richer in organics than what was present in Block 2 indicated that topsoil was also added in this area. A scattering of twentieth-century artifacts was recovered from the test pits excavated in Block 1.

The stratigraphy in Block 2 was primarily unmodified. It consisted of an average of 22 cm. of an organic deposit over a glacially deposited soil. All of the test pits in this block, except for one which landed on a boulder, were excavated. A scattering of historic artifacts were recovered from the test pits; no prehistoric artifacts were recovered. A section in the center of the block appeared to have been disturbed by mechanical equipment for the extraction of soil and boulders. This section exhibited gouged-out areas surrounded by boulders and earthen berms.

Assessment

It appears the area covered by Block 1 was heavily modified when the area was cleared. This modification included the depositing of a fill and perhaps a top soil. The area has been so heavily modified that any archaeological deposits that were present have been seriously compromised. The scattering of historic artifacts recovered from the block probably represents accidental deposition, perhaps in association with the fill, rather than any long-term or intensive use of the area. The single prehistoric artifact that was recovered at the site came from the fill. The lack of any additional prehistoric artifacts suggests that the preform was deposited with the fill and was not originally deposited in the project area.

Block 2 also exhibits twentieth-century disturbance in the form of mechanical extraction of soil and boulders. This area is confined to a section in the center of the block; the rest of the block appears to be undisturbed. However, except for a scattering of twentieth-century artifacts, no significant archaeological deposits were identified.

Due to the modern disturbance to the site and the lack of significant historic and prehistoric deposits, it is clear that no archaeological resources exist within the impact zone of the station.

7.8 Visual Impacts

Due to the location of the site adjacent to a depressed section of tracks, the station and the elevated pedestrian overpass will not be highly visible. The overpass will be reached by covered stairways and access ramps from both the north and south sides of the tracks. From the parking level, one ramp will go down to the north side platform and the other will go up to the overpass. The overpass will clear the tracks by 22 feet and have a total height of about 30 feet above the tracks when the roof is added.

There will be a platform canopy about 150 feet in length and 15 feet in height above the tracks to protect waiting commuters on the inbound or south side of the tracks. The canopy will be visually screened by topography and vegetation.

The parking area on the north side of the tracks will have landscaping on the periphery and between the station platform and the parking area.

The lighting is not expected to be an adverse influence. The existing nighttime light environment includes extensive lighting associated with the buildings on Tufts University Campus and the JobCorps facility. Cost-effective high pressure sodium light fixtures on 30-foot poles will be used in the parking lot. The lights will be of the cut-off type to minimize spillover to adjoining properties. Lighting will be turned on by photoelectric cells at dusk and turned off by the time clock approximately 30 minutes after the last evening train. There are only two residences in the vicinity of the station, both located on the south side of Route 30 west of Pine Street. Wetlands, topography and zoning preclude the likelihood of future residential development near the station.

7.9 Hazardous Materials

An environmental site evaluation was performed for the proposed Grafton Station site. The purpose of the evaluation was to determine whether hazardous material or oil may be contained in the soils or groundwater at the site, within the meaning of Massachusetts General Laws, Chapter 21E (21E). The purpose of 21E and its implementing regulations (310 CMR 40.00 - The Massachusetts Contingency Plan) is to "ensure the protection of health, safety, public welfare, and the environment by establishing requirements and procedures for the discovery, notification, assessment of, and response to, releases and threats of releases of oil or hazardous materials, and by identifying these oils and hazardous materials which are subject to these requirements and proceedings."

The environmental site evaluation consisted of the following elements:

1. A review of the site's history, which indicated that the site has been vacant and undeveloped land and pastures since the early 1700s, and has been owned by the Commonwealth of Massachusetts since that time.

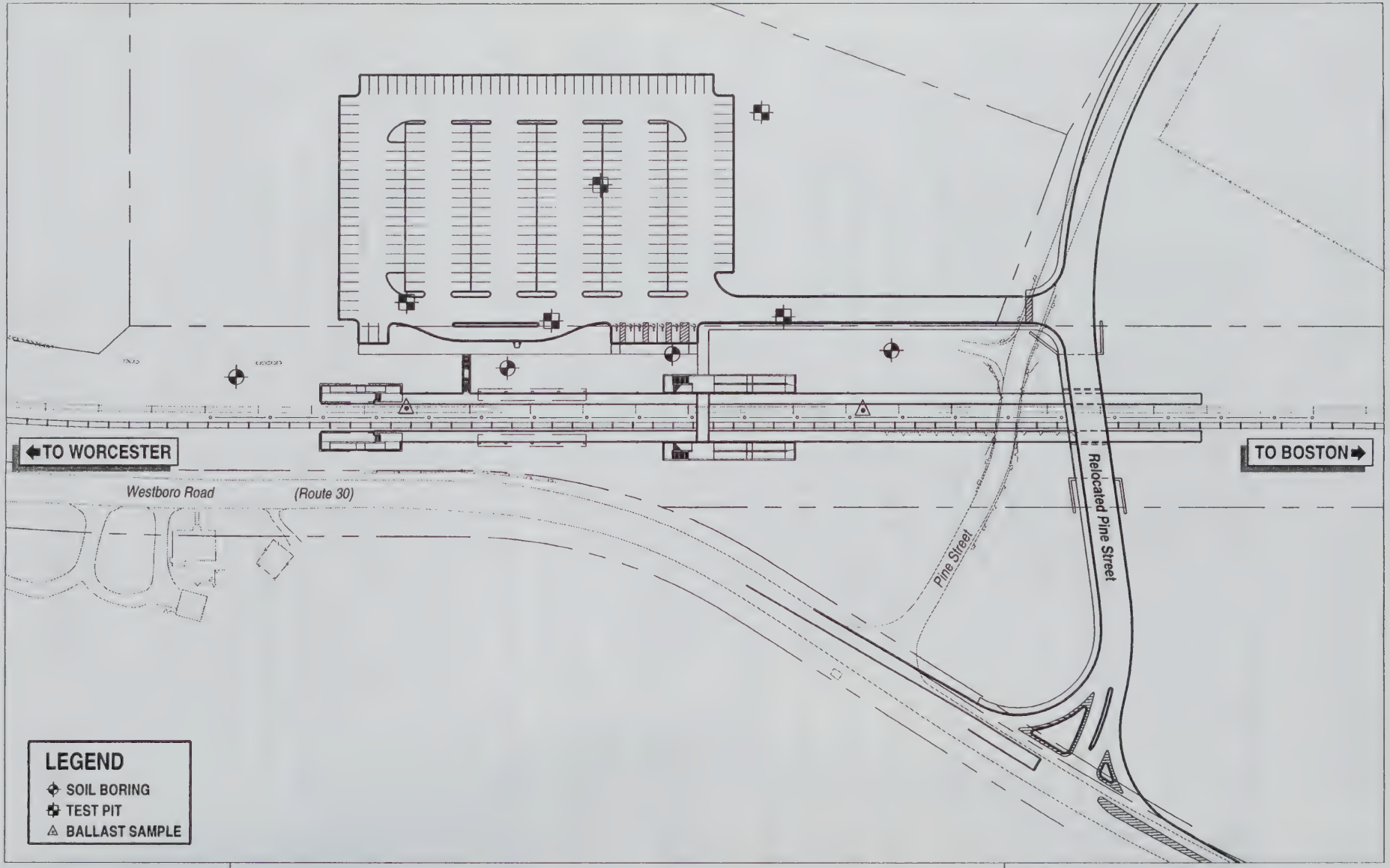
2. A review of state and local records which indicated no record of any spills/releases of hazardous materials or oil on the site or on properties within ¼ mile of the site.

3. A subsurface exploration program consisting of four soil borings, five test pits, and one monitoring well. Soil samples were taken from each of the borings and test pits. Figure 7.9-1 shows the location of wells and soil borings. Groundwater samples were taken at the monitoring well and at each of the test pits. The soil boring and test pit logs are available at the MBTA project office.

4. Soil and groundwater samples were analyzed in a laboratory by chemical screening methods.

The environmental site evaluation indicates the presence of trace concentrations of acetone and freon and levels of cadmium above expected background levels in the soil at the site. These concentrations of detected contaminants, however, are below the reportable concentrations established in the Massachusetts Contingency Plan. More specifically the environmental site evaluation results indicated the following:

- Results of the total volatile organic compound screening of soil did not detect organic compounds in the 32 of the 35 soil samples analyzed. Trace levels (less than 14 parts per billion) of acetone and freon were detected in the surface soil sample from one boring. The source of the detected contaminants is unknown.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 125'
0 125

SITE PLAN - HAZARDOUS MATERIALS INVESTIGATION (21E)
GRAFTON, MA

FIGURE 7.9-1

- No pesticides, herbicides, or Resource Conservation and Recovery Act 8 metals above background levels were detected in the composite surface soil sample collected at the site, with the exception of low levels of cadmium.
- No volatile organic compounds were detected in the three groundwater samples collected at the site. Results of the analyses of pH and specific conductance detected pH and specific conductance readings typical for New England groundwater in three of the groundwater samples.
- Polychlorinated biphenyls were not detected in the composite ballast sample collected from the railroad bed in the area of the proposed platform at the site. However, petroleum hydrocarbon concentration, 13 parts per million of motor/lubricating oil, was detected in this sample.

7.10 Pedestrian Safety

The CTPS ridership projections do not forecast any patrons walking to the Grafton Station; however, with the linkage between Tufts facilities in Grafton and Boston, some pedestrian traffic could occur between the station and the Tufts facility. Development of the industrial park northerly of the station could lead to future pedestrian traffic as well. Sidewalks will be provided on the station access road and along the reconstructed alignment of Pine Street. Provision of the sidewalk along Pine Street would accommodate the occasional patron who was dropped off at Route 30.

As noted elsewhere, intertrack fencing will be constructed through the station area to discourage pedestrian crossing of the tracks. A pedestrian bridge, accessible to the handicapped, will be constructed over the tracks to connect station platforms to parking facilities.

7.11 Construction

Construction related impacts typically involve issues of traffic to and from the work site, air quality, noise and vibration, erosion and sedimentation, and safety. Station site work will involve clearing, excavation, foundation construction, paving and installing/erection of site facilities such as pedestrian bridges and station canopies. Construction equipment likely to be used includes graders, bulldozers, backhoes, cranes and trucks.

Construction related traffic impacts are not expected to be significant. During certain short-term phases of construction, there will be concentrated deliveries of materials, such as during paving of the parking areas. Station construction will not be particularly labor-intensive, either, and traffic generated by the labor force will not adversely affect level of service on nearby roads.

There will be short-term, intermittent increases in emissions from construction equipment and site-related construction traffic. No violations of air quality standards are anticipated.

The application of water by spraying exposed earth surfaces can minimize the potential for fugitive dust from construction vehicle traffic or from wind erosion.

Silt barriers, consisting of hay bales and silt fence can be effective in trapping sediments from construction site runoff. Limiting the area of earth exposed at any one time can be effective in minimizing both wind and water erosion. Compliance with the requirements of an order-of-conditions issued by the Grafton Conservation Commission will ensure that adverse effects on water quality and resource areas are minimized.

Potential construction noise and vibration impacts and possible mitigation are described in the preceding Section 7.4.

Station site construction activities that present a potential safety concern would be secured by temporary fencing or other barriers. The Contractor will be required to adhere to all pertinent regulations regarding use and storage of hazardous or toxic materials on the site.

7.12 Proposed Mitigation

The results of the traffic analyses of the streets and intersections in the Grafton study area were reviewed to identify locations which may require mitigation in accordance with the MBTA Mitigation Policy outlined in Section 3.7.

Station generated traffic will not cause any study area street or intersection to deteriorate from an acceptable level of service to an unacceptable level of service. Side street traffic at two intersections, North Main Street/Bridge Street and North Main Street/Worcester Street, has unacceptable levels of service (LOS F) in the "No Build" condition. Station traffic will marginally increase delays at these intersections in the "Build" condition. Since the effect of station traffic is minimal, no mitigation is proposed.

The station site construction will displace wetland resources, in addition to work within the buffer zone. A detention pond is proposed to maintain stormwater discharge flows at or below existing conditions. All work affecting resource areas will be coordinated with the Grafton Conservation Commission.

Mitigation accomplished as part of the design includes the construction of 1,300 s.f. of wetland to replace 850 s.f. of wetland displaced by the station access driveway.

SECTION 8.0 ENVIRONMENTAL IMPACTS– FRAMINGHAM STATION

Introduction

The MBTA is in the process of upgrading the existing Framingham Station under a separate MEPA review (EOEA #10106). As noted in the ENF for the Framingham Terminal Project, the proposed improvements were to address commuter safety and accessibility, track operations, and commuter parking.

Prior to initiation of Interim Service between Framingham and Worcester in September 1994, the Framingham station was the terminus of commuter rail service on this rail line. A total of 31 trains (16 inbound and 15 outbound) stopped at the station weekdays, and Framingham boardings were 950 to 1,000 people per day.

Interim service extended one existing Framingham service train to Worcester and introduced two new trains in the A.M. commute, with a similar increase in the P.M. commute. Thus, the current interim service to Worcester added four new gate closings at the grade crossings in Framingham.

Two of the three interim service trains offer express trains to and from Boston, with stops at Framingham and West Natick. These trains have proven to be extremely popular, with the Framingham boardings currently at 1,350 to 1,400 riders each weekday, an increase of about 400 riders.

The increase in the number of gate closings and the increase in Framingham ridership resulting from Interim Service are impacts of the Worcester Service, and both have contributed to increased traffic congestion in the downtown Framingham area. While many of the new users of the train at Framingham walk to the station or use the LIFT bus routes, the effects of the attracted ridership include increased traffic congestion and competition for parking.

Thus, as described in the Notice of Project Change for the Framingham Terminal Development Project filed on November 30, 1995, this FEIR will address the traffic and parking related impacts at Framingham Station resulting from the Worcester Service.

With the anticipated implementation of Basic Service west of Framingham in 1996, an additional four daily gate closings will occur in Framingham. Basic service is not expected to attract significant new ridership at Framingham. Conversely, opening of stations at Millbury and Grafton will not divert riders from Framingham. By the year 2001, with added stations in Westborough, Southborough, and Ashland in service, weekday boardings at Framingham are projected to be lower than prior to introduction of Interim Service in 1994.

8.1 Framingham Terminal Elements

Prior to the initiation of Interim Service the Framingham Terminal served as the MBTA's regional terminus for Boston Metrowest daily commuter rail service. It is located within an active rail freight yard which is considered a local hub of Conrail operations. The project site is bounded by Waverly Street (Route 135) and Concord Street (Route 126) on the south and east respectively, by the Conrail yard and the MBTA commuter parking lot on the northeast, and by Farm Pond on the northwest. (See Figure 8.1-1).

As presented in the Environmental Notification Form (ENF) for the Framingham Terminal Project, which was noticed in the Environmental Monitor on August 23, 1994, the proposed project is to improve commuter safety and accessibility, track operations and parking. The ENF addressed Phase 1 improvements only, including construction of a pedestrian overpass with handicapped access; extension of the commuter platforms with covered access; relocation of approximately 1,400-feet of track to increase track centers from a substandard 12 feet to 14 feet; installation of intertrack fencing; and construction of a commuter drop off/pick up area while increasing the 48 parking spaces off Waverly Street to 50 spaces (see Figure 8.1-2). Implementation of the Phase 1 improvements is anticipated in 1997 following completion of the environmental approval process and final design.

Phase 2 improvements, which are considered an independent project from Phase 1, would include the construction of an additional 350 parking spaces in the Conrail north yard immediately north of the station platforms. Phase 2 currently is not being considered for construction. It is anticipated that a decision on Phase 2 will be driven by the need for additional commuter parking after the parking demand at Framingham is reduced significantly by the construction of commuter stations to the west in Westborough, Southborough, and Ashland.

The Secretary of the Executive Office of Environmental Affairs (EOEA) issued a Certificate on the ENF on September 22, 1994. The Certificate found that an Environmental Impact

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Approx. Scale: 1" = 2000'

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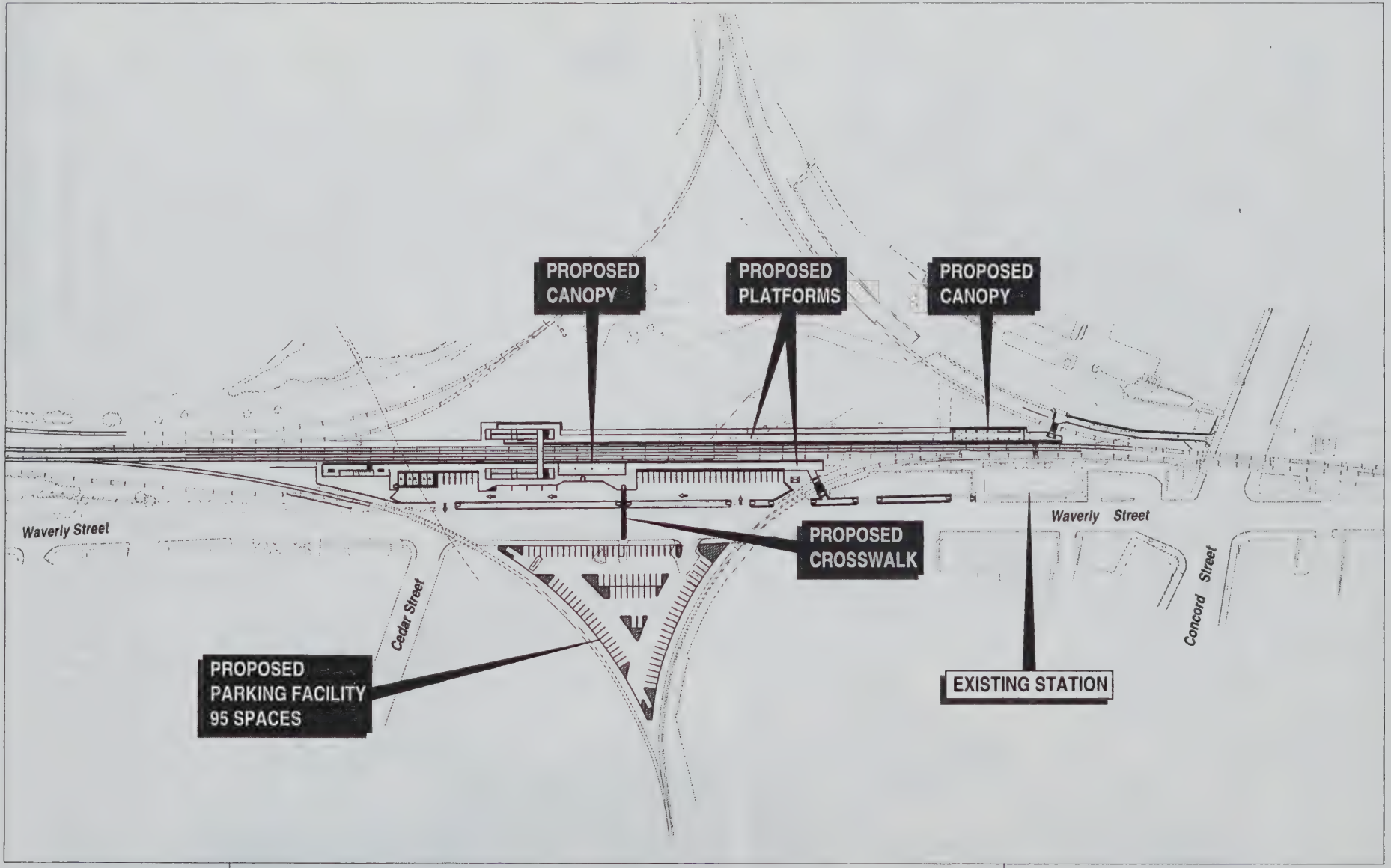
LOCUS MAP
FRAMINGHAM STATION

FIGURE 8.1-1



Massachusetts Bay Transportation Authority

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SITE PLAN
FRAMINGHAM STATION

FIGURE 8.1-2

Report (EIR) would be required for the Phase 1 project. As proposed, the project involved the demolition of the existing platform canopy structure as a result of track relocation. Since the station building and related structures, including the canopy, are listed on the National Register of Historic Places, the project is categorically included thus requiring preparation of an EIR pursuant to MEPA Regulation 301 CMR 11.25 (20). The scope of the EIR was limited to the review of potential impacts to National Register elements and allowed other aspects of the Phase 1 project to proceed.

In an effort to resolve the canopy issue, the MBTA submitted a Notice of Project Change (NPC) on November 30, 1995. The Notice revealed that the canopy would be removed, restored, relocated, and thus preserved. Supporting documentation to the NPC included a basic agreement with the Massachusetts Historical Commission to preserve the canopy and requested that the Secretary of EOEA reconsider the requirement for an EIR. Included in that presentation was a request to allow the MBTA to deal with traffic and parking concerns at Framingham as part of the ongoing MEPA review of the Worcester Commuter Rail Extension Project (EOEA No. 9154). In a Certificate issued on January 10, 1996, the Secretary agreed with the above request.

Since the issuance of the ENF, the Framingham Terminal Development has been revised to include the construction of 95 commuter parking spaces on the south side of Waverly Street west of the Waverly Street/Concord Street Intersection (see Figure 8.1-2).

Pertinent communications regarding the above matter, including the Notice of Project Change and the Certificate on the Notice, are included in Appendix B of this document.

8.2 Local Traffic

This section provides a summary of the complete traffic analysis included in this FEIR as Appendix I. The traffic analysis for Framingham Station focused on the two existing signalized intersections on Route 126 north and south of the station and the Route 126 grade crossing. The traffic analyses addressed three conditions—1994 prior to initiation of Interim Service, 1996 with introduction of Basic Service to Millbury and Grafton stations, and 2001 Basic Service to all proposed stations west of Framingham. Level of Service (LOS) was calculated for the two signalized intersections for the three traffic years, for both A.M. and P.M. peak hours.

A discussion of the LOS rating system is presented in Section 1.1 of the November 1994 DEIR Appendix, Volume I. A summary of the LOS designations is as follows:

Rating	Judgment
A	Little or no delay
B	Short traffic delays
C	Average traffic delays
D	Longer than average delays
E	Very long traffic delays
F	Severe congestion, demand exceeds capacity

Background of Traffic Study

Traffic congestion in the Framingham Central Business District, which includes the area adjacent to the MBTA Commuter Rail Station, has been of concern for many years. The Intersection of Route 135 (Waverly Street) and Route 126 (Concord Street) is located directly at the southeast corner of the station. The other intersection in close proximity to the station is Route 126 and Howard Street. Route 135 and Route 126 are major corridors through the downtown area, and each carries a high volume of traffic. Route 135 is the only arterial running in the east/west direction from Ashland to Natick. Route 126 is one of two major north-south arterials connecting the downtown area with Route 9 and the Massachusetts Turnpike (I-90); the other being Union Avenue.

The railroad crosses Route 126 at grade between Route 135 and Howard Street, with the crossing closer to Route 135. Gate arms are provided for vehicular and pedestrian traffic. The only pedestrian access between north and south sides of the tracks is the grade crossing (a locus map is shown on Figure 8.1-1).

In November 1995, the Town of Framingham received proposals for a comprehensive corridor study for Route 126, including the two intersections described above. Traffic problems in downtown Framingham have been in existence for over 100 years, and at least 36 previous studies have addressed the traffic congestion issues. The existing ROW is constrained by the store fronts on both sides of the roadways within the downtown business area. The existing roadways are over capacity and the heavy traffic volumes extend beyond the normal peak hours of the day. Area wide extensive study and analysis will be necessary to evaluate and quantify potential improvements within the existing physical constraints. The Town of Framingham recognizes that the traffic problems are not caused solely by the MBTA proposed improvements, and the MBTA recognizes that additional gate closings will irritate the existing traffic operational conditions. The MBTA is working closely with the Town's Public Works Department and Planning Department to evaluate options to alleviate impacts of Worcester service in the vicinity of Framingham station. Any proposed mitigation will be consistent with the impacts caused by the additional gate closings and commuter rail traffic.

The focus of the study for Framingham Station is to evaluate options to improve the Level of Service at the two existing signalized intersections on Route 126 adjacent to the station and the Route 126 grade crossing. The Town of Framingham has its own consultant studying signal improvements in the vicinity of the Bishop Street grade crossing located about 2,000 feet east of Framingham Station.

Traffic Data and Analysis Methodology

The Town of Framingham assisted in obtaining the most recent traffic counts that were completed for other projects in the area. Turning movement data along Route 126 and Route 135 were provided for the 1996 A.M. and P.M. peak hours. Recent studies concluded that traffic background growth has been a steady 2% per year for the past three years.

The traffic analysis for evaluating the effects of Worcester Commuter Rail Extension employed the following methodology.

- The baseline condition is represented by 1994 traffic volumes which existed prior to initiation of Interim Service to Worcester in September 1994. Traffic volumes were derived by factoring 1996 volumes to subtract two years of background growth and by deducting the additional traffic volumes generated by the increased Framingham station patronage resulting from Interim Service trains. Volumes for 1994 A.M. and P.M. peak hours are shown on Figures 8.2-1 and 8.2-2.

- Interim Service has been operational for a sufficient period of time so that the current ridership at Framingham Station can be assumed to be at its peak. The 1996 traffic volumes represent the maximum traffic impacts of Worcester Service on roadways near the station. Traffic volumes for 1996 A.M. and P.M. peak hours are shown on Figures 8.2-3 and 8.2-4.

- Future year 2001 traffic volumes were derived by increasing background traffic by 2% per year, and factoring in the volume of traffic that will be generated by station patrons in the year 2001. Traffic volumes for year 2001 A.M. and P.M. peak hours are shown on Figures 8.2-5 and 8.2-6.

Interim Service to Worcester

As noted previously, Interim Service has added four new gate closings at the grade crossings in Framingham—two in the A.M. peak commuting hours and two in the P.M. peak commuting hours. The additional gate closings impact to a certain extent the two intersections adjacent to the grade crossing—Route 126 at Route 135 and Route 126 at Howard Street.

Basic Service to Worcester

The introduction of Basic Service to Worcester at the end of 1996 will provide 10 train operations in each direction per day west of Framingham Station. Twelve of the total of 20 daily operations are extensions of current trains between Framingham and Boston, and eight operations are new (compared to the 31 operations to Framingham that existed prior to Interim Service. Basic Service therefore, results in eight additional gate closings from the 1994 baseline conditions—four added by Interim Service and four more added by Basic Service. Of the increase, two occur in the A.M. commuting hours, two occur in the P.M. commuting hours and the remaining four occur outside of peak commuting hours.

Traffic Distribution

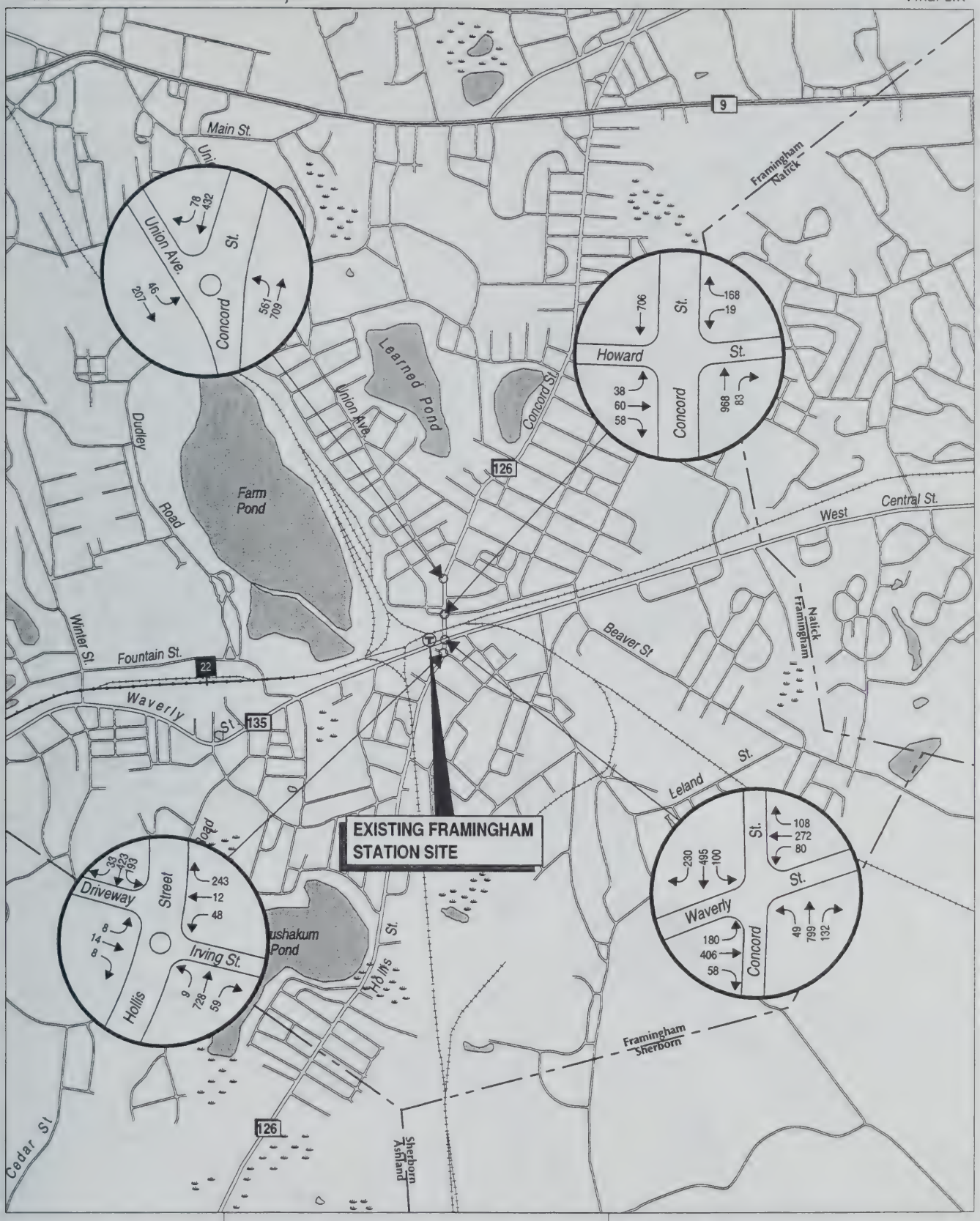
The distribution of traffic associated with the MBTA station was conducted based on population (town precinct) distribution and concentration relative to the station within the Town of Framingham, and the shortest access route from adjacent towns to Framingham Station. Table 8.2-1 shows distribution of Framingham Station ridership by town of origin.

Figures 8.2-7 and 8.2-8 show the distribution of commuter traffic at Framingham Station for the years 1996 and 2001.

Table 8.2-1 Framingham Ridership by Town of Origin

Town of Origin	1994 w/o Interim Service*	1996 with Basic Service**	2001 with Basic Service
Framingham	-	597	618
Holliston	-	168	32
Ashland	-	186	22
Southborough	-	81	
Hopkinton	-	103	
Marlborough	-	16	
Upton	-	22	
Westborough	-	63	
Northborough	-	65	
Other	-	66	70
Total	977	1367	742

* Distribution prior to Interim Service not available. Traffic analysis assumed distribution proportional to 1996 ridership.
** Applicable to 1996 with Interim Service as well.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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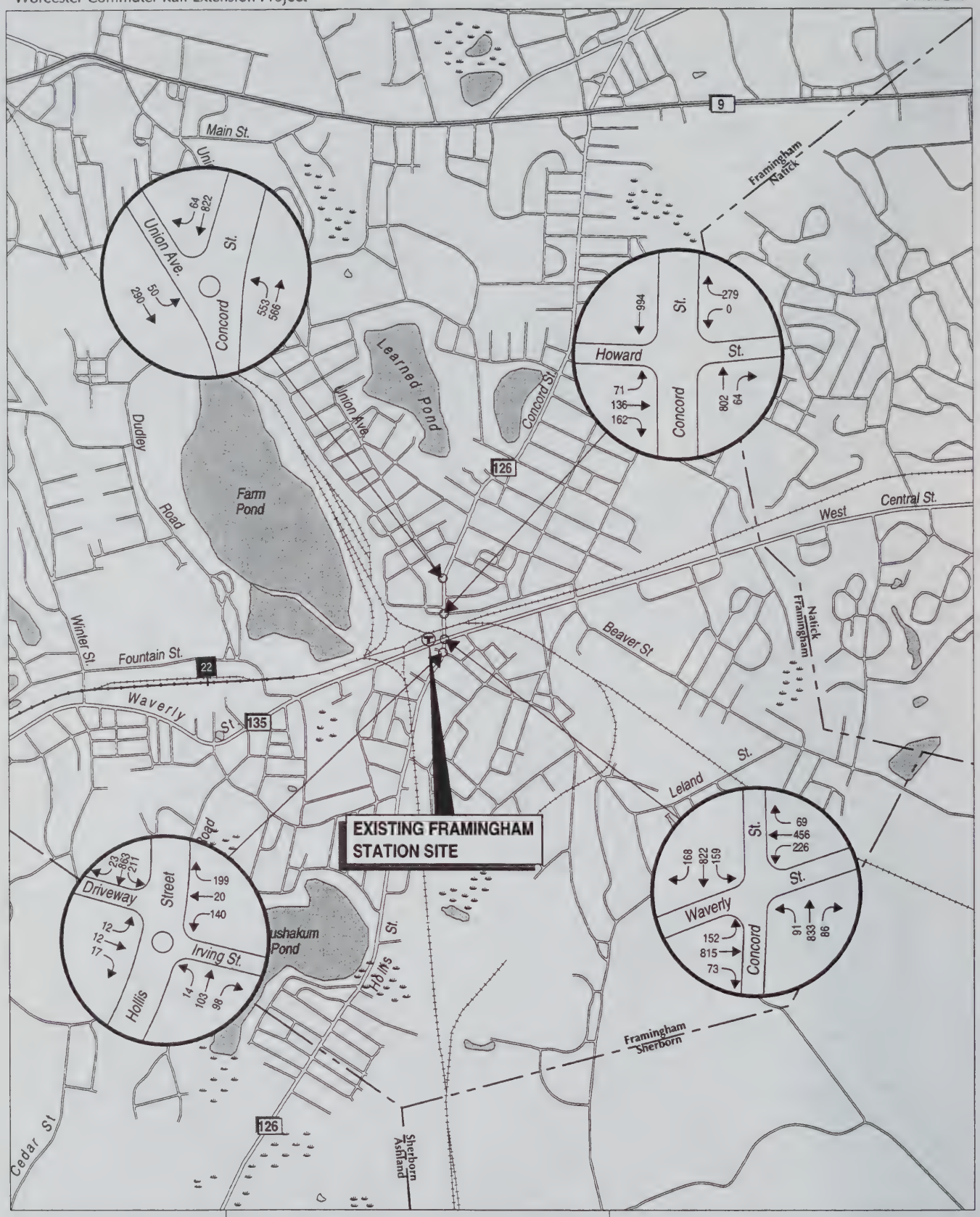
AM Peak Hour
1994 Existing Conditions
FRAMINGHAM STATION

FIGURE 8.2-1



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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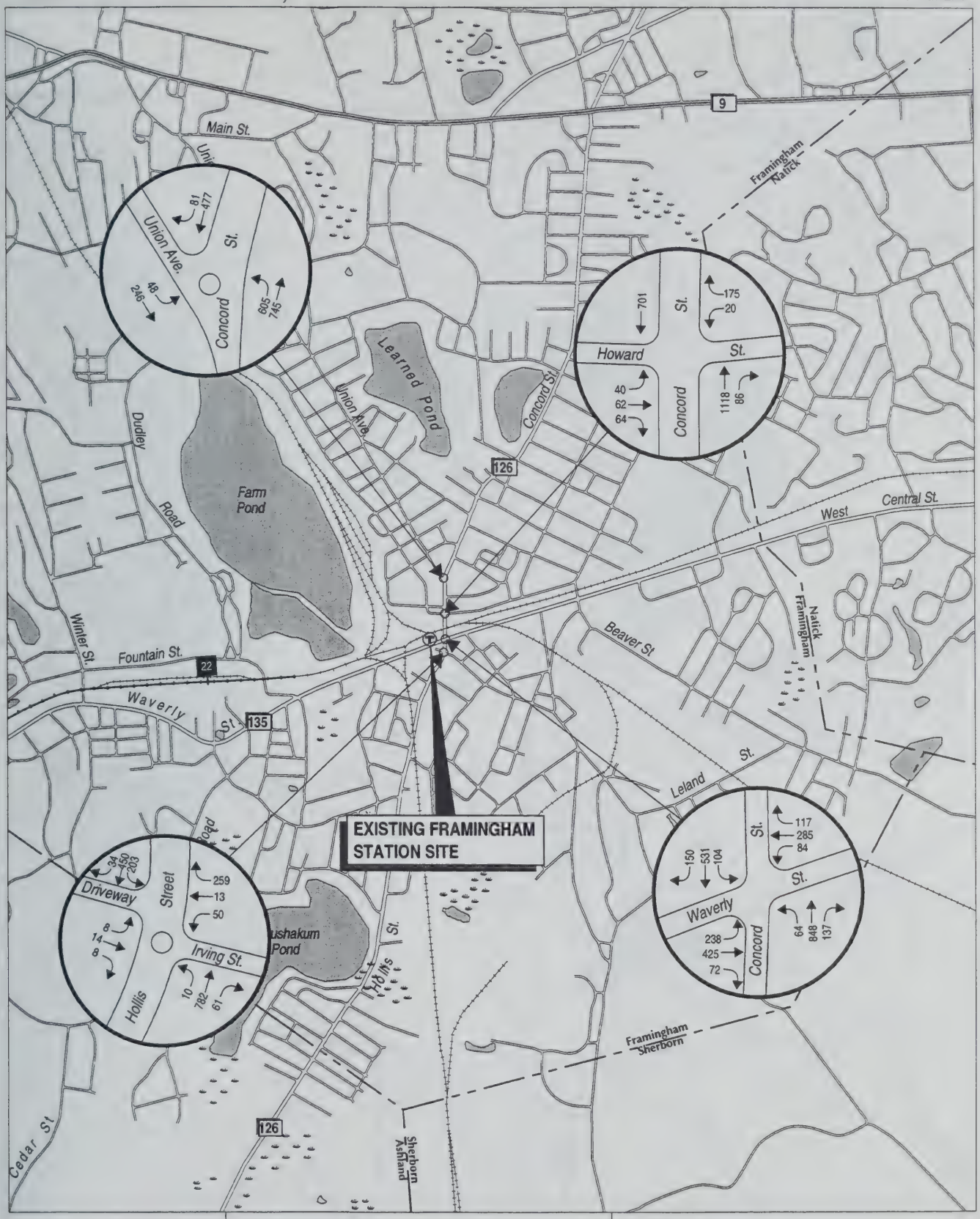
PM Peak Hour
1994 Existing Conditions
FRAMINGHAM STATION

FIGURE 8.2-2



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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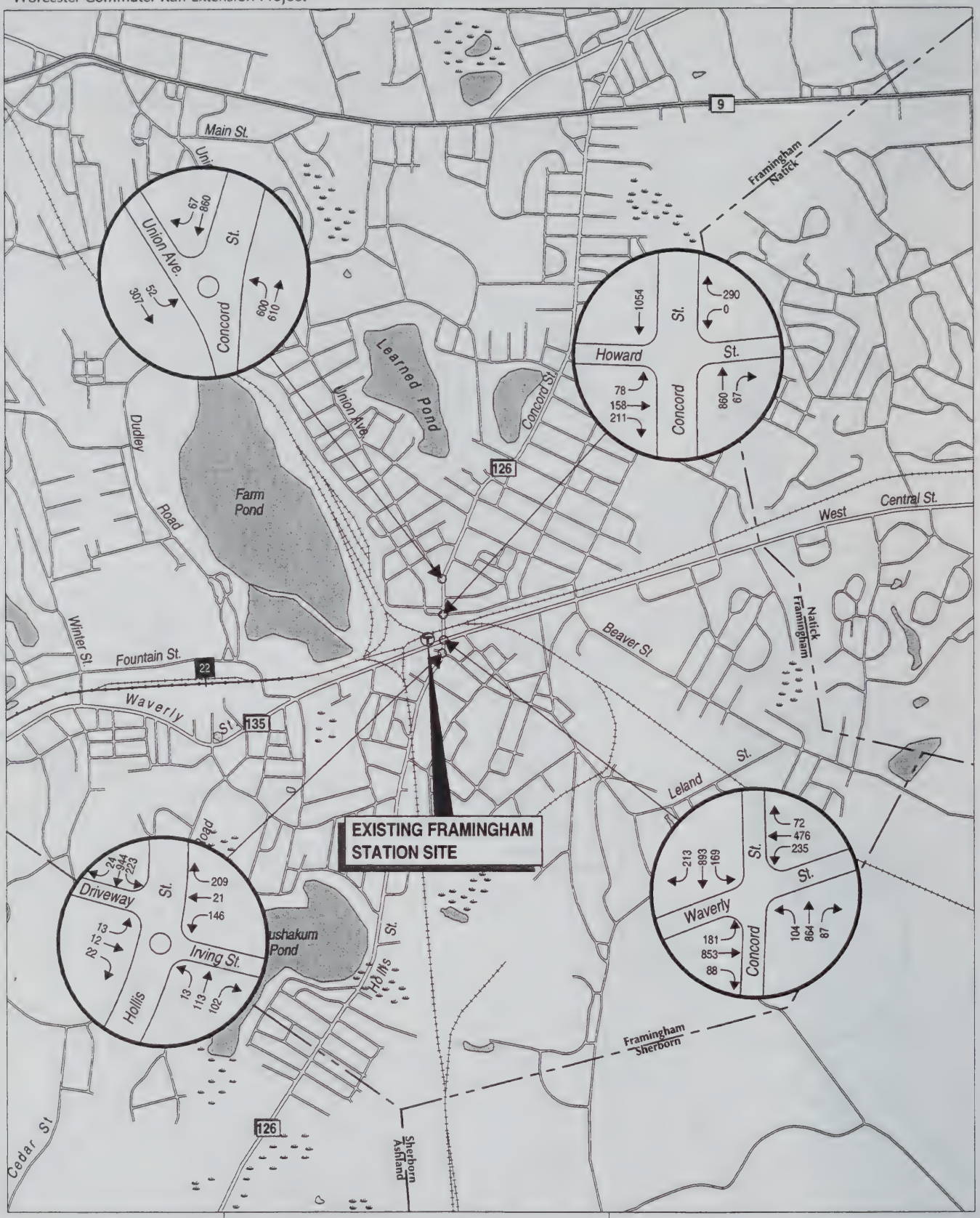
AM Peak Hour
1996 Build-Millbury & Grafton Only
FRAMINGHAM STATION

FIGURE 8.2-3



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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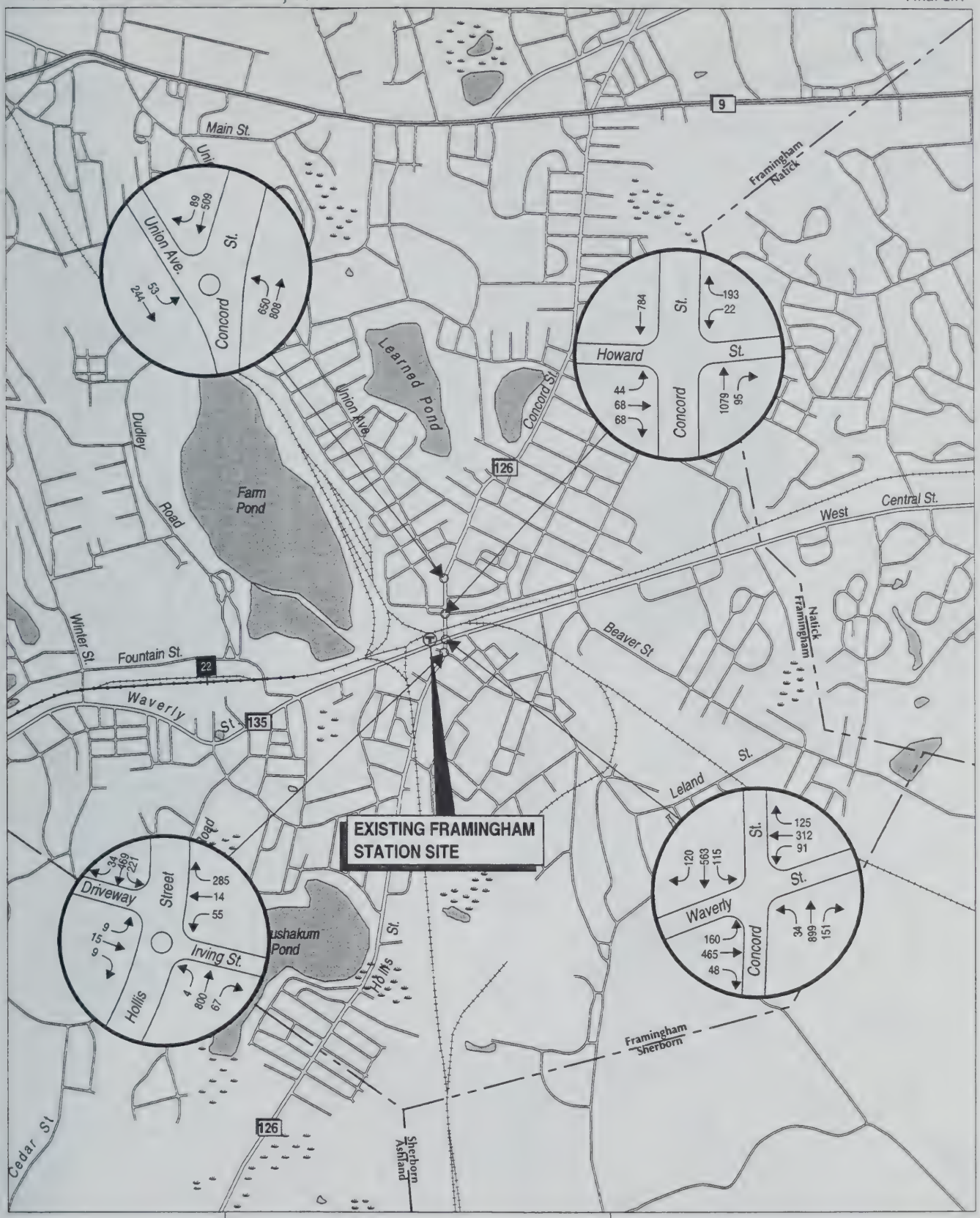
PM Peak Hour
1996 Build-Millbury & Grafton Only
FRAMINGHAM STATION

FIGURE 8.2-4



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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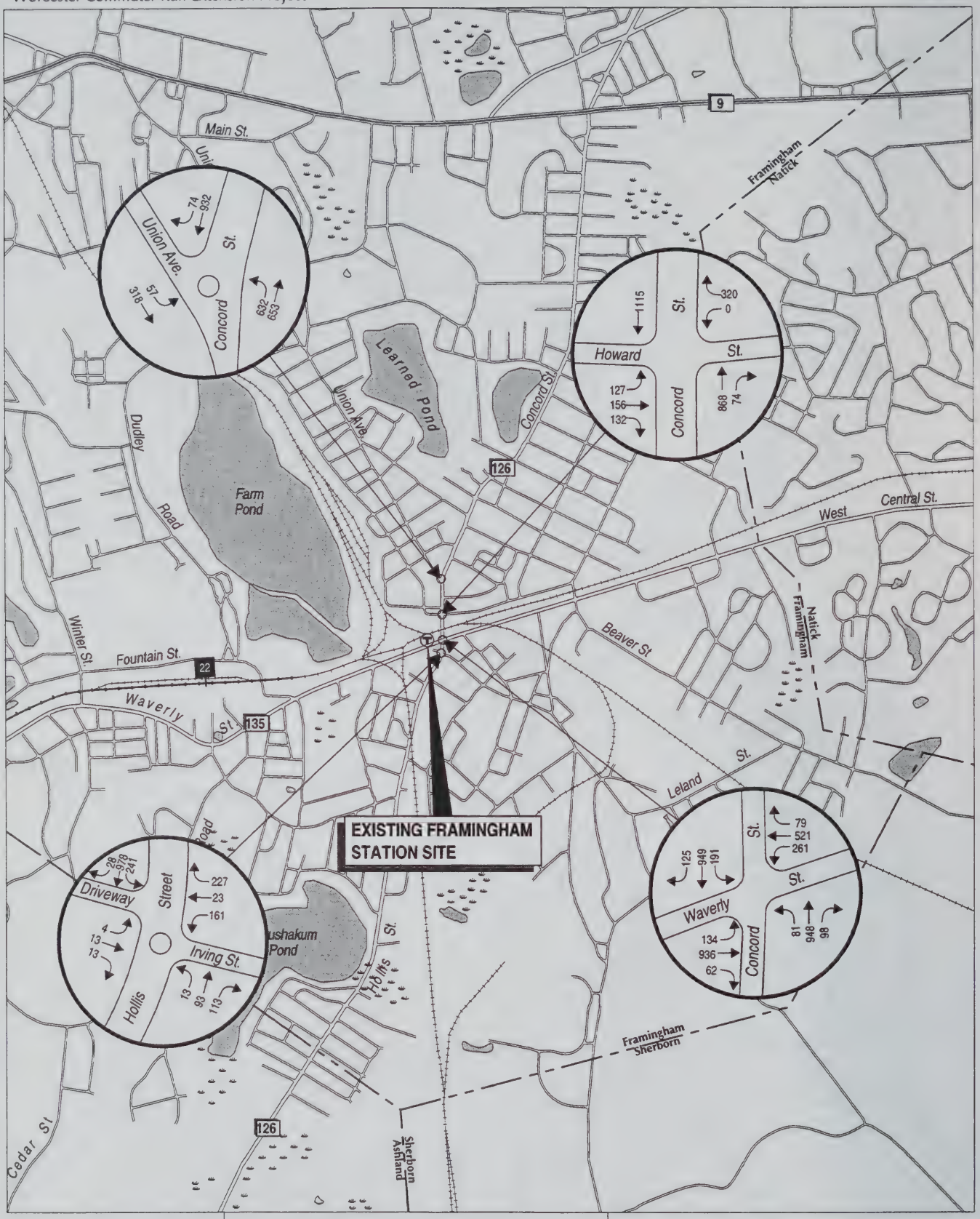
AM Peak Hour
2001 Build-All Stations
FRAMINGHAM STATION

FIGURE 8.2-5



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'
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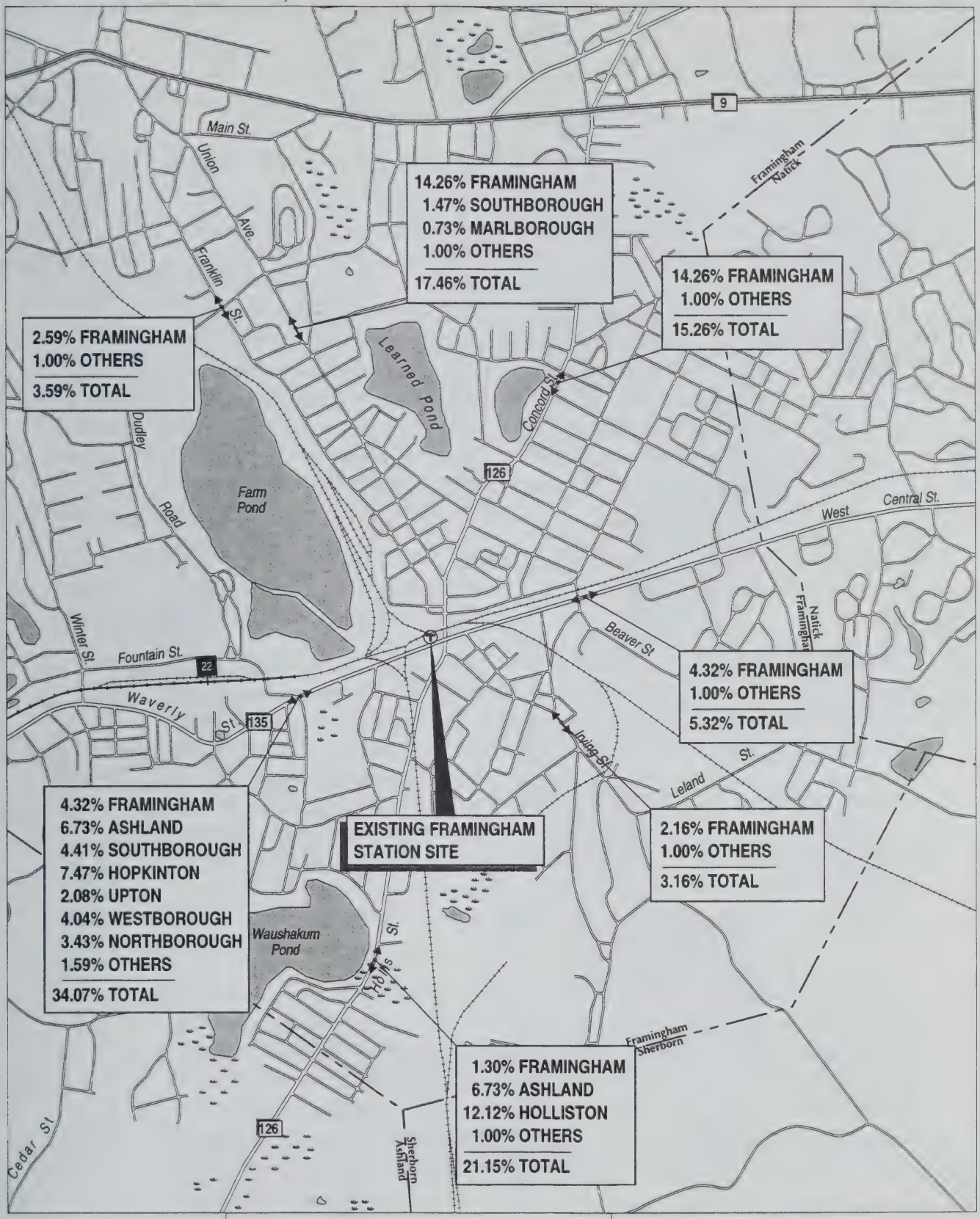
PM Peak Hour
2001 Build-All Stations
FRAMINGHAM STATION

FIGURE 8.2-6



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Approx. Scale: 1" = 2000'

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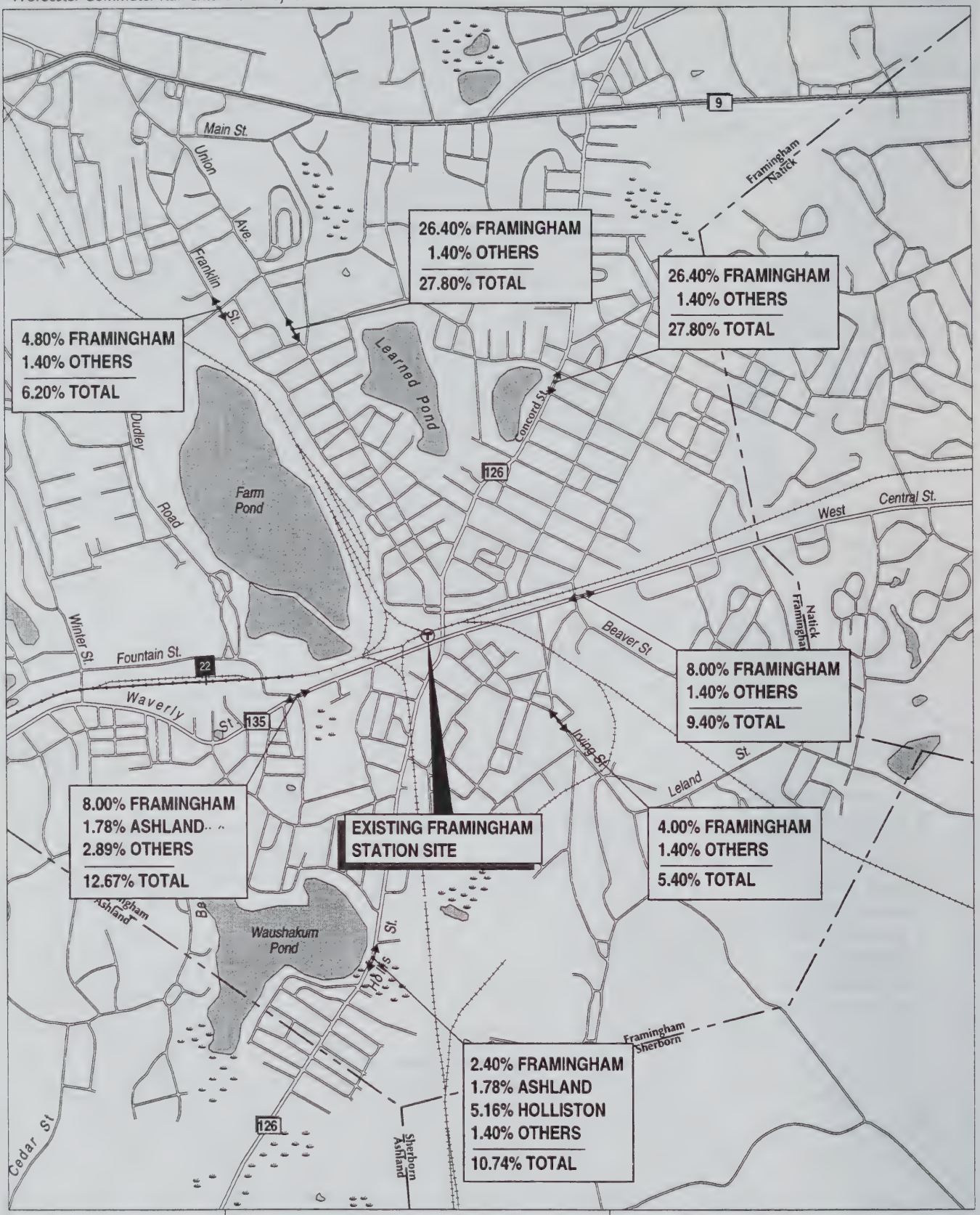
Distribution of Commuter Rail Station Traffic
1996 Build-Millbury & Grafton Only
FRAMINGHAM STATION

FIGURE 8.2-7



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Approx. Scale: 1" = 2000'

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Distribution of Commuter Rail Station Traffic 2001 Build-All Stations FRAMINGHAM STATION

FIGURE 8.2-8

Capacity Analysis

Using the traffic volumes derived for 1994, 1996 and 2001, Level of Service was calculated for the Route 126/Route 135 intersection and the Howard Street intersection for both A.M. and P.M. conditions, using the existing traffic signal timing and phasing. (See Tables 8.2-2, 8.2-3, and 8.2-4). The results of the analyses show that the Route 135 signal operated at LOS F in the 1994 A.M. peak, and LOS F in the 1994 P.M. peak. For 1996 and 2001, the intersection operates at LOS F in both the A.M. and P.M. hours. The average delay per vehicle worsens in 1996 compared to 1994, due to the additional traffic generated by Interim Service. By the year 2001, station generated traffic will decrease significantly from 1996; however, total traffic will be nearly as great as 1996, as the decline in station traffic will be offset by background growth of 2% per year. Without improvements, in 2001 the existing signal operation will result in more delay than 1994, but slightly less than in 1996.

The Howard Street intersection operates at LOS B for both A.M. and P.M. conditions in 1994; in 1996, the P.M. LOS is reduced to C. By the year 2001, the reduction in station traffic will restore the P.M. condition to LOS B.

From the above results, it is obvious that some remediation is needed to improve LOS at the Route 135/Route 126 intersection. The existing constraints at the intersection prohibit major physical changes to the roadway geometry. Revised channelization and prohibition of on-street parking would permit the addition of more traffic lanes. Two design alternatives were evaluated for this intersection. Alternative 1 provides three lanes on the southbound and northbound approaches on Concord Street and two lane approaches on eastbound and westbound Waverly Street. Prohibition of parking would be necessary on the northbound approach on Concord Street and the south side of Waverly Street east of the intersection, a reduction of approximately 5 spaces on each street (Figure 8.4-1). Alternative 2 would not prohibit parking, in which case, the northbound Concord Street approach can provide only two lanes (Figure 8.4-2).

For either alternative a new state-of-the-art traffic controller system would be installed, fully actuated and traffic responsive, which will make intersection operations more efficient. The results of the capacity analyses show, that even with a new signal system, the LOS at Route 135 will remain F in 1996 and 2001 if no additional traffic lanes are constructed (Alternative 2). A new signal installation can result in more efficient operations, resulting in lesser average delay per vehicle compared to the existing signal design; however, the improvement is not sufficient to achieve LOS E or better (see Table 8.2-5).

By constructing additional traffic lanes (Alternative 1) in conjunction with the new signal system, the LOS at this location can be improved to D in the A.M. peak hours. For P.M. peak hours, delays will be reduced dramatically compared to existing conditions but operation will remain LOS F (See Table 8.2-5).

The Howard Street signal operates at an acceptable LOS for all years analyzed; however, it is an outdated signal installation. To maximize efficiency of traffic operations near the Framingham Station, it is necessary to replace signals at both Howard Street and Route 135 with state-of-the-art installations, and interconnect both signals with the railroad preemption for the gate closings. Signal timing and phasing can be adjusted to ensure that traffic queues clear the grade crossing prior to the gates closing. Timing and phasing can also be designed to allow for certain traffic movements to occur during gate closings as long as the movements do not conflict with the grade crossing closure.

Table 8.2-2 Signalized Intersection Level of Service - Existing Conditions

Location	1994	
	AM	PM
Route 126 (Concord Street) at Route 135 (Waverly Street)		
Eastbound	F	F
Westbound	F	F
Northbound	F	F
Southbound	E	F
Overall	F	F
Route 126 (Concord Street) at Howard Street		
Eastbound	C	C
Westbound	C	B
Northbound	B	B
Southbound	A	B
Overall	B	B

Table 8.2-3 Signalized Intersection Level of Service - Route 126 at Route 135

Location	Existing Conditions		Proposed Conditions Alternative 1		Proposed Conditions Alternative 2	
	AM	PM	AM	PM	AM	PM
1996						
Eastbound	F	F	D	F	F	F
Westbound	F	F	D	E	F	F
Northbound	F	F	D	F	F	F
Southbound	D	F	C	F	D	F
Overall	F	F	D	F	F	F
2001						
Eastbound	F	F	E	F	F	F
Westbound	F	F	E	F	F	F
Northbound	F	F	E	F	F	F
Southbound	D	F	C	F	D	F
Overall	F	F	D	F	F	F

Table 8.2-4 Signalized Intersection Level of Service - Route 126 at Howard Street

Location	Existing Conditions		Proposed Conditions	
	AM	PM	AM	PM
1996				
Eastbound	C	D	C	C
Westbound	C	B	C	B
Northbound	B	B	B	B
Southbound	A	B	A	B
Overall	B	C	B	B
2001				
Eastbound	C	C	C	C
Westbound	C	B	C	B
Northbound	B	B	B	B
Southbound	A	C	A	B
Overall	B	B	B	B

Table 8.2-5 Summary of Delays* - Route 126 at Route 135

Location	Existing Conditions		Proposed Conditions Alternative 1		Proposed Conditions Alternative 2	
	AM	PM	AM	PM	AM	PM
1994	106	302	-	-	-	-
1996	232	INF	30	134	207	275
2001	205	INF	38	165	208	433

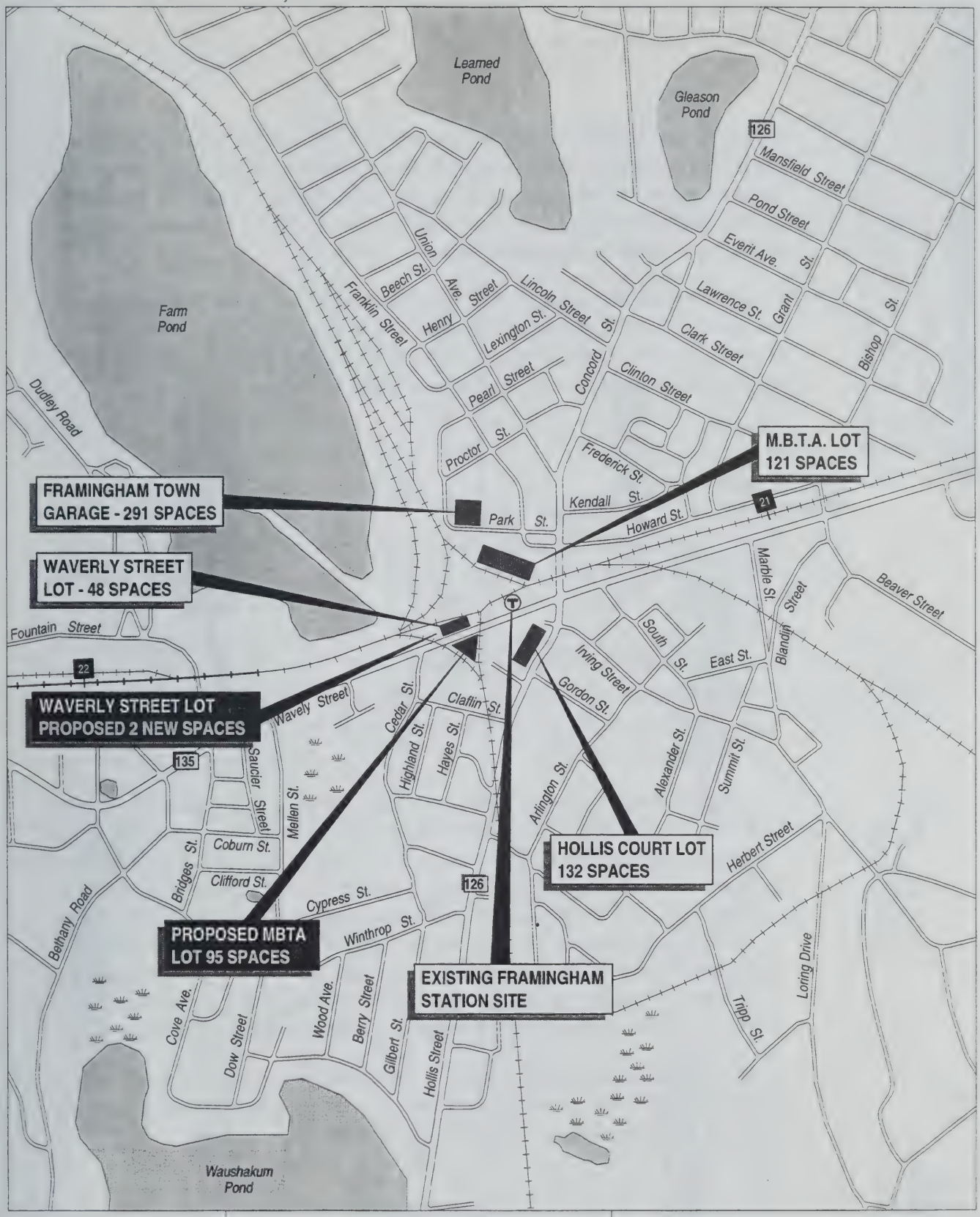
* Average delay, in seconds of time, per vehicle passing through the intersection. Any value in excess of 60 is considered LOS F.

INF = Infinity, which is an indication of a breakdown of the intersection operation.

8.3 Parking

Existing parking facilities accessible to the general public and located within walking distance of the Framingham Station are shown on Figure 8.3-1. Although nearly 600 parking spaces appear to be available for commuters, a first-come-first-serve rule must apply. It is clear that, since the introduction of Interim Service from Worcester in the Fall of 1994, ridership from Framingham Station has increased from about 1,000 people per day to at least 1,400 people per day on weekdays. The present ridership creates a demand for parking that exceeds the supply. The excess demand is difficult to quantify. Since there has not been any parking expansion since Interim Service began, we must speculate that a significant change in mode of access to the station may be taking place. It is likely that the share of walk access trips and kiss and ride trips (drop offs) has increased. It is also probable that the average auto occupancy of park and ride trips has increased markedly (up from 1.12 persons per vehicle used for all other stations). The use of the LIFT buses and a recent increase in illegal parking (reported by the Town) may also be factors in dealing with insufficient parking.

By the end of 1996, with stations on line in Grafton and Millbury, CTPS projects that Framingham ridership will total 1,367 daily commuters. Based on the normal vehicle occupancy rate of 1.12, and allowing for the normal walkers and kiss and ride patrons, the parking demand will total 690. With the construction and operation of stations in Ashland, Southborough, and Westborough sometime in 1997. The Framingham ridership is projected to decrease to 709 patrons with a parking demand for about 360 spaces. Adequate parking should then be available, freeing up spaces in the town garage for non-commuters.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1000'

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COMMUTER PARKING AT FRAMINGHAM STATION

FIGURE 8.3-1

CTPS is planning to conduct an on-board passenger survey at Framingham Station as well as a detailed parking inventory survey. The results of these surveys will be used to verify our speculations regarding changes in access mode. The survey will be designed to obtain information regarding the passengers' mode of access to the station and their primary travel mode prior to Interim Service.

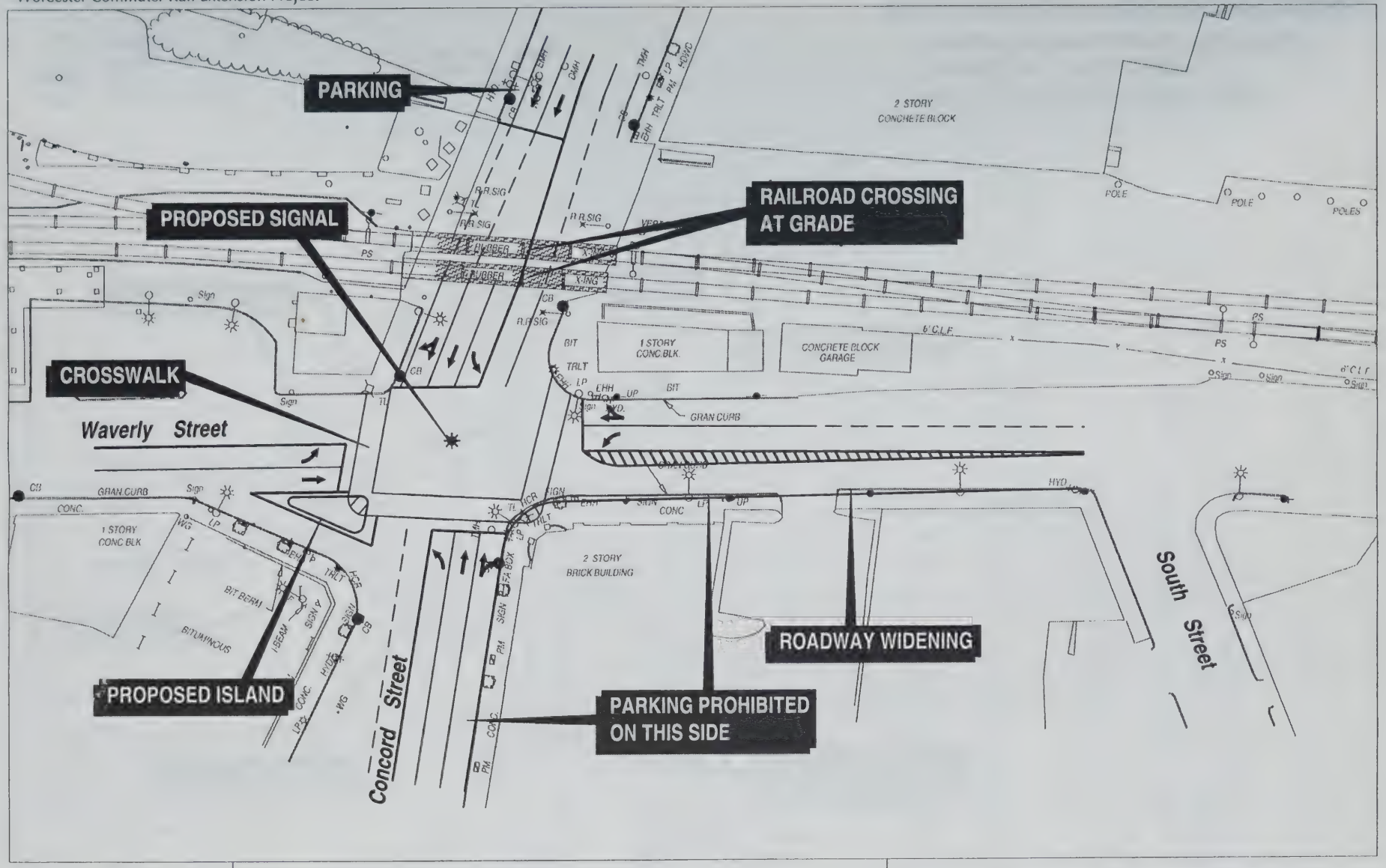
In the meantime, the parcel of land in the former railroad wye on the south side of Waverly Street will be developed to provide 95 new spaces. These additions (shown on site plan, Figure 8.1-2) will help alleviate the shortage of spaces available to station patrons, but demand may continue to exceed supply for the near term.

8.4 Proposed Mitigation

The MBTA proposes to mitigate the impacts generated by the additional gate closings by providing immediate improvement at the two adjacent intersections. The proposed improvements will consist of the following:

Route 126 (Concord Street) at Route 135 (Waverly Street)

- Replace the existing outdated signal control system with new state-of-the-art, fully actuated traffic control system that conforms to the Manual on Uniform Traffic Control Devices (MUTCD).
- Construct one of the two alternatives provided in this document. Alternative 1 (Figure 8.4-1) consists of providing exclusive left turn lanes of all approaches to the Intersection, providing two through lanes on the northbound and southbound approaches and providing one through lane each of the eastbound and westbound approaches. A new island will be constructed at the eastbound approach to provide an exclusive right-hand side turn movement on that approach and provide safer pedestrian crossing. Curbside parking on the right side of the northbound approach entering the intersection, and the right-hand side of the eastbound roadway exiting the intersection will be prohibited, affecting approximately 10 parking spaces.
- The Alternative 2 configuration (Figure 8.4-2) will be the same as in Alterative 1 except there will be only one through lane on the northbound approach, and parking would be allowed in areas prohibited in Alternative 1.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 60'

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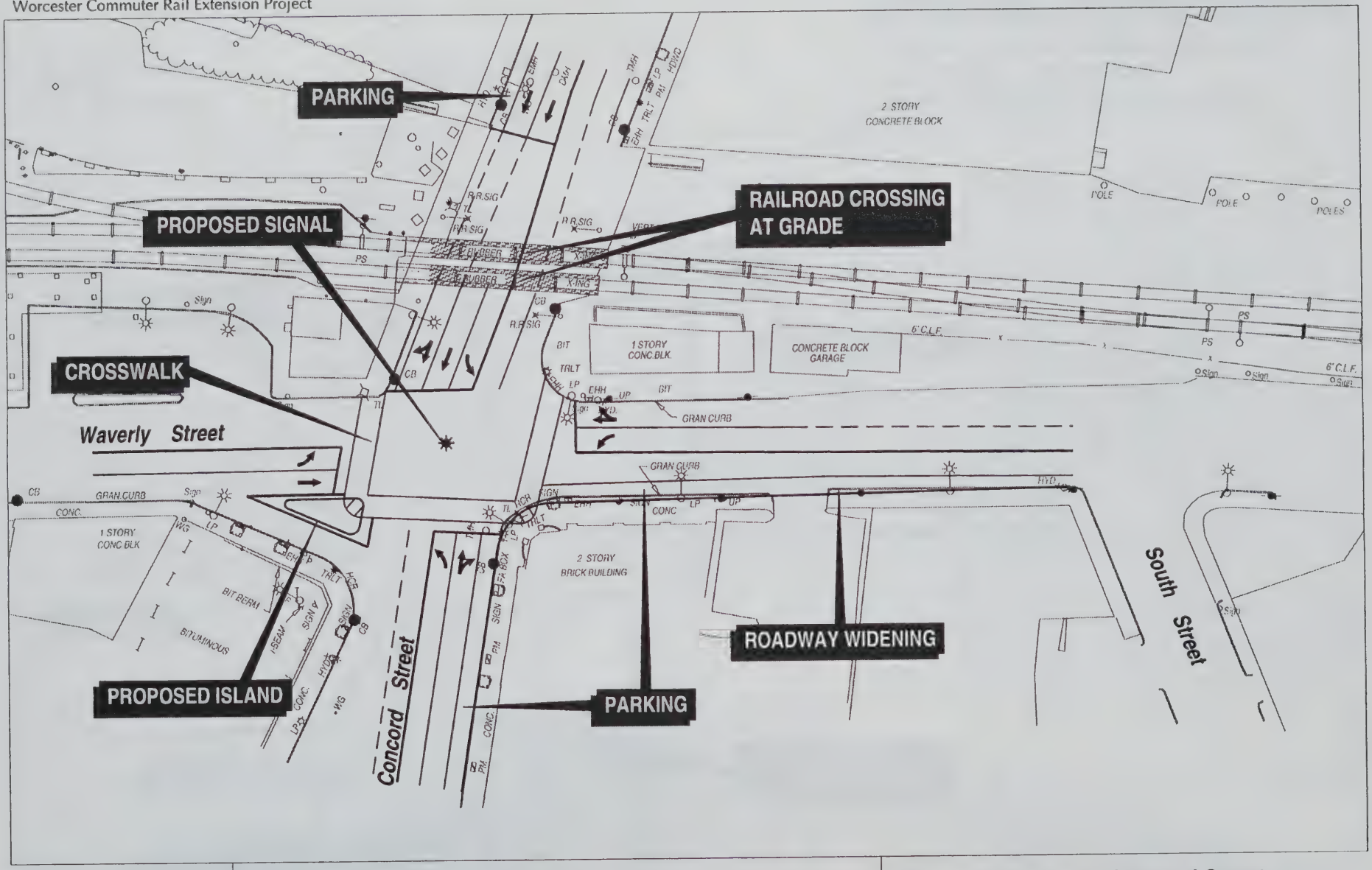
Waverly Street and Concord Street Intersection - Framingham Proposed Improvements - Alternative 1

FIGURE 8.4-1



Massachusetts Bay Transportation Authority

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Waverly Street and Concord Street Intersection - Framingham Proposed Improvements - Alternative 2

FIGURE 8.4-2

- On each approach to the intersection, approximately 300 feet of the existing pavement will be cold-planed and resurfaced. New pavement marking and signing will be installed. Minimal widening to improve the roadway alignment is also included.
- Inter-connect with railroad preemption and Howard Street signal.

Route 125 (Concord Street) at Howard Street

- Replace the existing traffic signal control with new system conforming to MUTCD requirements.
- Pavement cold-planing and resurfacing of approximately 200 feet on each approach to the intersection.
- Install new signing and pavement marking.

The proposed mitigation will improve the traffic flow through the intersections, and the capacity analysis indicates that delays will be reduced. In addition to the physical improvements at the two intersections, the new parking spaces provided south of Waverly Street will attract riders arriving from the south and west to park south of the track crossing and therefore reduce the number of vehicles crossing the tracks. Vehicles traveling through both intersections will also be reduced, further improving the level of operation on the roadway network near the station.

The proposed improvements are consistent with discussions held with the Framingham Public Works and Planning Departments and address level of impact introduced by the additional gate closings and station traffic generated by the Basic Worcester Service.

Discussions will continue between the MBTA and the Town.

8.5 Construction Costs

The estimated mitigation cost at the two intersections will total $290,000. Table 8.5-1 provides a breakdown of the estimated costs.

Table 8.5-1 Construction Cost Estimates

Project Element	Estimated Cost
Roadway Construction	$75,000
Traffic Signals	$160,000
Pavement Marking and Signing	$10,000
Subtotal	$245,000
Design and Construction Services	$45,000
Total Cost	**$290,000**

SECTION 9.0 RESPONSE TO COMMENTS

Introduction

The EOEA Certificate on the Draft EIR (March 16, 1995) cited 87 letters from commentors addressed to the Secretary of Environmental Affairs (adding some late comments, the comment list grew to 98). The EOEA Certificate on the Final EIR for Railroad Right-of-Way and Layover Facility (September 14, 1995) cited 9 letters from commentors. This section of the report summarizes concerns that were frequently raised in the comment letters. Since the impacts associated with this project are primarily spread across seven communities, including the five towns in which a commuter rail station has been proposed as well as Framingham and Worcester, many of the comments were specific to a particular community. Many of these frequently raised comments were also raised by the Secretary in a more generic manner in her certificate. For this reason a response to these issues, as raised in the Secretary's Certificate, is being provided to address common concerns expressed by all commentors.

The frequently raised issues focused on the following subject areas: alternative transportation modes; revenue issues; regional station alternative; ridership projections; rail line impacts (noise and vibration and mitigation funding); and station development sequencing.

A general response to concerns in each of these subject areas is presented in this section, with individual comments addressed in Appendix - Volume I, a separate document.

9.1 Responses to Commonly Raised Questions

Alternative Transportation Modes

Alternatives to Worcester Rail must meet the standard of applicable state and federal regulations. The Massachusetts Department of Environmental Protection (DEP) allows alternatives to Worcester Rail to be advanced only if Worcester Rail is determined to be infeasible. The EPA has added DEP's requirement to the Massachusetts State

Implementation Plan (SIP) under the Clean Air Act. The legislature has added its voice here as well, by funding the MBTA's proposed rail alternative and its required rolling stock.

Neither the DEIR nor this FEIR comes anywhere near meeting the regulatory standard for considering alternatives to Worcester Rail. Instead, Worcester Rail is not only very far from infeasible, but it is, by most comparisons in terms of riders diverted from highway travel, preferable to any obvious alternative. Many commentors expressed the opinion that the proposed rail alternative was not obviously superior to one or more bus alternatives, or that rail and bus ought somehow to operate in tandem. The MBTA must respectfully disagree, based on the CTPS data of the DEIR and this FEIR. This data strongly suggests that Worcester Rail will transport more riders than any rail/bus or bus alternative. These results are corroborated by an MBTA survey conducted in February, 1995, which showed that Worcester Rail interim service caused only a very small diversion from existing bus service. Apparently, the Boston-Worcester commuter market is segmented: many drivers would shift to train service, but not to bus service; few drivers would shift from bus service to train service.

Both feasible and desirable, Worcester Rail should and must go forward, and be operational by the end of 1996.

Revenue (Cost- Benefit and Affordability)

Given the feasibility of the Worcester Rail alternative, including financial feasibility underwritten by legislative bond authorization, there is no need for an elaborate discussion of cost-benefit and affordability issues, especially as alternatives are involved. The DEIR states that Worcester Rail will have a 42% rate of recovery for operations, quite favorable compared to other MBTA commuter rail lines, and well above the MBTA's target of 33 1/3%. Worcester Rail also performs well on other financial measures against other commuter rail alternatives considered. Worcester Rail is well within the MBTA's overall financial capacity, as Sections 2.1 and 2.2 demonstrate. Worcester Rail has been included in two financial analyses which have recently undergone MEPA review. These analyses cover costs of operating and maintaining the existing MBTA system as well as building and operating a program of new projects including Worcester Rail.

Regional Station

This issue is no longer before MEPA but the MBTA wishes to offer this update. At the request of the General Court, the MBTA, through its contractor Howard/ Stein-Hudson Associates, has been developing a report which reviews the issue of the feasibility of a regional station near the junctions of I-90, Massachusetts Route 9 and I-495 to serve the Worcester Rail project. After an extensive review involving substantial opportunities for

public participation, MBTA's contractor on January 31, 1996 delivered a report finding many of the possible sites for a regional station to be infeasible for one or another reason, and finding as well that the costs of site development and site access for any such station were prohibitive in view of the modest increment of riders projected to use it. The ridership data was generated from a detailed regional travel model used for transportation analyses by the Central Transportation Planning Staff (CTPS) of the Executive Office for Transportation and Construction (EOTC).

Ridership

Ridership data from the DEIR were reexamined and new projections have been developed for Framingham ridership and for a regional station and several combinations of the intermediate stations proposed between Worcester and Framingham in the DEIR, viz. Millbury, Grafton, Westborough, Southborough, Ashland ("the base stations case"). Where relevant, the DEIR data and the new data track very well, though the new data aggregates include Framingham, for which there were no DEIR estimates. The highest projected ridership is associated with the base stations case (save Westborough) plus a regional station, but the increment added by the regional station is not large—in year 2011, under 200 additional. Without a regional station, approximately 3,500 riders in year 2011 (including Framingham) would be served at most, but by several different combinations of stations, including the base stations case. Even when overall ridership stays at 3,500 in 2011, there can be considerable ridership shifts among stations when fewer intermediate stations than in the base stations case are included in the analysis. But in some departures from the base stations case, ridership drops below 3,500 in 2011, to as low as 2,160. In all cases below 3,500 riders in 2011, there are substantial ridership shifts among stations compared to the base stations case of 3,500 riders in 2011. See Appendix D of this FEIR for updated CTPS ridership projections.

Noise and Vibration

In the DEIR and subsequent FEIRs, the MBTA has analyzed the effects of noise and vibration along the railroad corridor to address changing design and service scenarios. The impacts of noise and vibration, originally analyzed for 70 mph maximum speed and service to all intermediate stations, has been revisited for 60 mph maximum speed and service to Millbury and Grafton only as well as service to all stations. Vibration impacts on commercial properties have also been investigated in response to commenter concerns.

The updated noise analyses show that for implementation of Basic Service, impact will occur at 7 single family residences. Construction of a noise barrier, at an estimated cost of $80,000, can provide up to a 10 dBA noise residence at 5 of these homes located on

Westborough Road in Grafton. The barrier meets the MBTA's criterion of cost-effectiveness and the MBTA is committed to installation of the barrier subject to abutter concurrence.

Basic Service to all stations will result in vibration impact to 15 homes along the corridor. The noise characteristics of MBTA locomotives makes mitigation technologically ineffective.

Station Development

The MBTA plans to analyze under MEPA its preferred alternative, which was described in the DEIR. In making final decisions about station development, community preferences around stations will be reviewed in light of MBTA obligations under 310 CMR 7.36 and under the Massachusetts State Implementation Plan as governed by the Clean Air Act. The timing of station development includes the construction and operation of the Millbury Station and Grafton Station by the end of 1996. The Westborough, Southborough, and Ashland Stations, in response to many similar comments, will be addressed, together and relative to various combinations of a regional station with local stations, in a subsequent Final EIR.

9.2 Individual Comments and Responses

In addition to the Secretary's Certificate, 98 comment letters were received on the November 1994 Draft EIR and 8 comment letter were received on the July 1995 Final EIR for Railroad Right-of-Way and Layover Facility. Appendix - Volume I, a separately-bound document, contains each comment letter with individual comments labeled in the margin. Following the comment letters, each individual comment is quoted followed by a response.

The complete list of comment letters on the November 1994 Draft EIR, with the Secretary's Certificate designated as Comment Letter No. 1, is as follows:

MEPA Correspondence

1.	EOEA DEIR Certificate	3-16-95
2.	Citizens Advisory Committee Comments on DEIR	11-9-94

State Officials and Agencies

3.	MA Senate/Senator Matthew J. Amorello	3-9-95
4.	MA Senate/Senator Robert A. Durand	3-6-95

5. House of Representatives/Harriette L. Chandler	3-7-95
6. Department of Food and Agriculture/Marcia Starkey	3-6-95
7. MA Historical Commission/Brona Simon	3-9-95
8. DEP Central Region/Mary J. Richards	3-9-95

Regional Agencies and Organizations

9. Central MA Regional Planning/Carl Hellstrom	3-9-95
10. MA Restaurant Association	2-5-95
11. MA Audubon Society/E. Heidi Roddis	3-8-95
12. Bicycle Coalition of MA/John Allen	1-22-95
13. Metropolitan Area Planning Council/David Soule	2-28-95
14. METROWEST/Charles E. Gaffney	3-7-95
15. Assoc. for Public Transportation/Dennis Campbell	3-8-95
16. MASCO/Robert Tassinari	2-16-95

City Officials, Agencies and Organizations

17. MBTA Advisory Board Capital Planning Committee/Bernice Mader	3-8-95
18. Preservation Worcester/Patrice O'Malley Hagan	2-27-95
19. Worcester Office of Planning and Community Development/ Stephen F. O'Neil	2-24-95
20. Union Station Alliance	3-9-95
21. Andrew B. O'Donnell/Member Worcester Commuter Rail Task Force	3-9-95
22. Worcester City Manager's Office/Thomas Hoover & David Forsberg	3-13-95
23. Worcester Business Development Corporation/Thomas J. Andrews	3-9-95
24. Millbury MBTA Advisory Committee/Brennan F. Wall	2-1-95
25. Tufts University/Franklin M. Loew	2-24-95
26. Grafton Board of Selectmen	3-6-95
27. Southborough Board of Selectmen	3-7-95
28. Westborough School Committee/Lydia DaSilva	3-1-95
29. Westborough Planning Board/Richard Brady	2-21-95
30. Westborough Board of Selectmen	3-6-95
31. Westborough Police Department	2-27-95
32. Westborough Historical Commission	1-10-95
33. Westborough MBTA Advisory Committee	3-3-95
34. People for the Ashland West Alternative/John Kelly	2-17-95
35. Ashland Board of Selectmen	3-6-95
36. Ashland MBTA Rail Committee	3-9-95
37. Ashland Town Planner/Stephen Kerlin	3-9-95
38. Ashland Office of Selectmen and Town Manager	11-22-94
39. Framingham Planning Department	3-7-95
40. Hopkinton Office of the Selectmen	3-8-95
41. Hopkinton Appropriations Committee/John Woodward	3-8-95
42. Newton Department of Planning and Development	3-2-95
43. Wellesley Board of Selectmen	1-6-95
44. Boston Redevelopment Authority	3-6-95

45. Boston Environmental Department	3-8-95

Millbury - Citizen Comments

46. Brennan F. Wall	2-17-95

Grafton - Citizen Comments

47. Scott Rossiter	2-12-95

Westborough - Citizen Comments

48. Larry Gomes	2-24-95
49. Louis & Maureen Jankauskas	2-21-95
50. Mary Fisher	2-24-95
51. Mary Cullen	2-20-95
52. Stephen & Charlene Henry	2-24-95
53. Brian and Antoinette Kenned	3-7-95
54. Mario Avelloni	3-3-95
55. E. Thomas and Judith McCabe	3-6-95
56. Sally Tajiani	3-5-95
57. Janice and Alan Silvestry	3-5-95
58. Rosemary Johnson	3-6-95
59. Diane Power	3-7-95
60. Dennis Cox	3-8-95
61. Jacqueline and David Cox	3-8-95
62. Robert Brais, Barbara Brais, Marie Brais	3-5-95
63. Dorothea MacLeod	3-6-95
64. Marvin Silver	3-7-95
65. Barbara Reismann	3-7-95
66. William and Mary Anne Coveney	3-6-95
67. Jane and Richard Dunphy	3-4-95
68. Joseph Orlando	2-20-95
69. Elizabeth Colbert	2-22-95
70. Joseph Harrington	2-14-95
71. Mrs. Paul Smith	2-21-95
72. Helen and Bill Panas	2-17-95
73. William Murphy	2-8-95
74. Jennifer Speed	3-7-95
75. Bruce Johnson	3-6-95
76. Cheryl and Paul Crivello	2-28-95
77. Susan Stager	2-26-95
78. Ellen Gugel	1-19-95
79. Barbara Sullivan and Fran Lynch	1-29-95

Southborough - Citizen Comments

80. Richard Fournier, Jr.	3-5-95
81. James Knowles	2-23-95
82. Peter Venuto	2-23-95
83. Patricia Pirozzi	2-14-95
84. James Waddell	2-14-95
85. Russell Fustino	10-4-94
86. Jane Fedorowicz and Michael Golibersuch	2-8-95
87. Anne Huff	1-8-95
88. Judith and Thomas Little	2-2-95

Ashland - Citizen Comments

89. Burnam's Supper House/Daniel Giargiari	3-3-95
90. Nelson Holden	3-6-95
91. Claudia Lefter for Nelson & Martha Holden	2-8-95
92. Citizens Lefter, Leacu, Camille, Holden	3-7-95
93. Ellen Giargiari	2-28-95

Hopkinton - Citizen Comments

94. John Woodward	1-6-95
95. Andrew and Teresa Boyce	2-2-95

Boston - Citizen Comments

96. Keith Davison	3-3-95

Unknown Communities - Citizen Comments

97. Dorothy McMahon	3-7-95
98. Jackie Adams	3-6-95
99. Julia McTigue Jacobs	---

The complete list of comment letters on the July 1995 Final EIR, with the Secretary's Certificate designated as Comment Letter No. 1, is as follows:

MEPA Correspondence

1. EOEA FEIR Certificate	9/14/95
2. Citizens Advisory Committee, Comments on FEIR	9/05/95

State Officials and Agencies

3.	Massachusetts Historical Commission/Brona Simon	9/06/95
4.	DEP Central Region/Mary J. Richards	8/31/95
5.	MHD District No. 3/Peter J. Donohue, P.E.	9/07/95

City Officials, Agencies and Organizations

6.	Southborough Board of Selectmen	9/06/95
7.	Worcester Office of Planning and Community Development/Stephen F. O'Neil	8/31/95

Grafton - Citizen Comments

8.	Lydia M. Bogar	9/06/95

Boston - Citizen Comments

9.	Keith K. Davison	9/07/95

APPENDIX A

MEPA CORRESPONDENCE

1.	MEPA Certificate on November 1994 DEIR	3-16-95
2.	Notice of Project Change	5-12-95
3.	MEPA Certificate on Notice of Project Change	6-22-95
4.	MEPA Certificate on FEIR #1	9-14-95
5.	Notice of Project Change	10-31-95
6.	MEPA Certificate on Notice of Project Change	1-10-96

The Commonwealth of Massachusetts
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March 16, 1995

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Worcester Commuter Rail Extension Project
PROJECT LOCATION	: Statewide
EOEA NUMBER	: 9154
PROJECT PROPONENT	: Massachusetts Bay Transportation Authority
DATE NOTICED IN MONITOR	: December 7, 1994

The Secretary of Environmental Affairs herein issues a statement that the Draft Environmental Impact Report submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (G. L. c. 30, s. 61-62H) and with its implementing regulations (301 CMR 11.00).

Overview

The Draft Environmental Impact Report (DEIR) has evaluated the environmental impacts and issues relating to the proposed initiation of commuter rail service along an existing 23 mile rail corridor between the Framingham commuter rail line and the City of Worcester. The service will use the Conrail track which passes through Worcester, Millbury, Grafton, Westborough, Southborough, Ashland, and Framingham. A second track will be re-laid along 11 miles of existing roadbed from Westborough to Worcester. An interim service along this route was reinstated to Worcester in the fall of 1994, and was recently reported to be very successful in attracting ridership. Full service is scheduled to be operational by December 31, 1996, as required by the air quality regulations of the Department of Environmental Protection (DEP).

The DEIR was pre-reviewed by the Citizens Advisory Committee (CAC) and comments from the CAC were included in the DEIR. Generally, these comments appear to be comprehensive, accurate, and fair. They should receive full consideration in the FEIR. Citizens in the municipalities affected by the project have shown

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a high level of interest in this project, as well; their comments are referenced in this Certificate and listed below. Sensitivity to these concerns should be demonstrated in revisions and refinements to the project design and siting, in the operational plans, and in the commitments to the environmental mitigation proposed in the FEIR.

Subsequent to this DEIR review, the MBTA will be considering the appropriateness of bringing forward certain elements of the project sooner than others. This could be handled in separate FEIR reviews. Information gathered during the DEIR review gives some preliminary indication of the advantages and disadvantages of such a plan. The City of Worcester, Office of Planning and Community Development comment, for example, has identified a need to complete the permanent layover facility as soon as possible because of the neighborhood complaints regarding noise and diesel fumes at the temporary layover site in the Providence and Worcester rail yard.

The Special Procedure established for this project would enable separate review of project components. However, this would need to be accomplished so as to avoid any inadvertent shift or increase in environmental impacts. As an example, the CAC comment raises the concern that there may be unexpected impacts associated with the advancement of individual stations out of phase with the others. The Committee recommended that the FEIR cover at least the Ashland, Southborough, and Westborough stations.

Another advantage of two separate and sequential FEIRs would be that the second FEIR could provide an additional opportunity to answer any outstanding issues raised during the review of the first FEIR. This would help to ensure that significant and controversial issues would be addressed to the greatest extent.[1] A proposal to prepare separate FEIRs should be filed as a Notice of Project Change with a recommendation for the topics to be considered in each document. This approach will provide additional opportunity for public comment.

The remainder of the Certificate will highlight important issues to complement and reinforce key concerns raised in the CAC comment and those listed at the close of the Certificate.

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[1] This could also give the Town of Ashland an opportunity to review and comment on station plans received late in the DEIR public review period.

Revenue Issues

Commenters have raised the issue of the MBTA's capability to finance this project while maintaining existing services and funding service expansions already approved, a concern driven by increases in project cost and reductions in the MBTA operating budget. Although a financial feasibility analysis reference in the DEIR (p. 3-48) concluded that the Old Colony project, major capital improvements including the Newburyport extension, and the reinstatement of the Worcester commuter line were within the overall financial capability of the MBTA, no supporting information was provided.

This is an important matter that warrants more discussion in the FEIR. As suggested in the comments, in a worst case situation the MBTA could be put in a position of having to make tough choices such as increasing fares, increasing assessments, reducing services, and deferring or eliminating mitigation in order to maintain and expand the transportation system. Should this occur, then the ridership gains of this project might be off-set by losses in ridership elsewhere in the system. The net effect could be increased vehicle miles of travel (VMT) and higher levels of air pollutants. The FEIR should provide sufficient information to demonstrate that the MBTA will be able to operate this project without adversely affecting its services elsewhere.

Commenters have also expressed concern about financial assessments which are imposed on communities within, and not those outside, the district, even though citizens in non-member communities will use the service. While I appreciate such concerns, I find they are not within the scope of MEPA review. In general, MBTA's financial systems and decision-making are mnot subject to this review, except to the extent they have implications for the environmental impacts of proposed projects.

Alternatives

Alternative Transportation Modes

The analysis of alternative transportation service options is a comparative summary of the Worcester Extension project with the No Build and Express Bus Service options. The analysis concludes that bus service cannot attain the level of ridership achievable by commuter rail. However, bus service is less expensive; operation and maintenance costs have been estimated to

be $1.53 million ($1.96 per passenger), compared with $5.08 million ($4.33 per passenger) for the Worcester Extension Service. According to the DEIR, environmental impacts appear to be somewhat less extensive with busing due to the fact that station facilities would be limited to parking. However, the impacts of the alternatives have not been quantified for comparative purposes and the information provided in this section of the DEIR allows only limited understanding of this matter.

The ridership projections for commuter rail and bus services were estimated based on census and other data for the cities and towns in the transportation system capture areas. Certain assumptions were also made about transportation networks and mode choice factors (p. 4-4) to arrive at the ridership estimates. Were these same assumptions used in the ridership study in Section 5? What mode choice factors were used for rail and bus services and how were those factors used in the analysis? What is the degree of accuracy of the ridership projections, given that 1980 census data were used? The inclusion of this information with the DEIR ridership study in Appendix II, Section 2 would have been appropriate.

A comparative analysis of vehicle miles of travel (VMT) and air emissions between Build and No Build conditions was based on the 1994 ridership projections (Section 5.5).[2] This analysis was done to show the regional air quality benefit of the Worcester Extension project. It was estimated that regional VMT will be reduced by 118,000 in 1996. This corresponds to a net VOC reduction of 113 kilograms per day (kg/day), a reduction of NOx by 199 kg/day and a CO reduction of 1584 kg/day. Because speeds on the Mass Pike are expected to increase to some extent, emissions reductions have been estimated to be greater than the effects of the commuter rail extension project.

Section 4 of the DEIR concludes with a comment that the Worcester Extension project is required by the Department of Environmental Protection (DEP), air quality regulations (310 CMR 7.36 (2) (c)2), unless substitution of an alternative becomes necessary because the engineering, environmental impacts, or economic impacts cause the project to be infeasible. Although it appears to be unintended, the limited text leads to the question the CAC has raised. Is this significant state transportation

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[2] The assumptions in this analysis have been discussed to a greater degree than the ridership projections used in the comparison between mode choices.

project justified primarily because it has been found to be "not infeasible?" A more thoughtful response (which may take note of recently published ridership data) is needed in the FEIR.

Regional Station Alternative

The DEIR provides enough information about potential regional station site alternatives to demonstrate that regional station siting for the commuter rail extension will be significantly more complicated and difficult than intermediate station layout and design, due in large part to environmental impacts and costs. In addition, the DEIR indicates that neither the ridership demand for a regional station nor the negative effects of the intermediate station plan are so compelling that a regional station must be advanced immediately and in spite of the environmental impacts and costs associated with it.

Commenters from the Town of Westborough have expressed an interest in the substitution of a regional station because of the impacts predicted at the Westborough station site. Concerns have been raised in other communities as well that an intermediate station could become, de facto, a regional station. Finally, the CAC and others have advocated strongly that a feasibility study of an I-495 regional station be undertaken before decisions are made on the intermediate stations.

I find that the DEIR has been responsive to the scoping certificate on this issue. I also note that the MBTA will be conducting a report to the Legislature on this issue in the near future, as directed by the recently passed Transportation Bond Bill. I request that the MBTA carefully consider the concerns and arguments raised during this review. I also request that the report to the Legislature be made available for public comment (through a notice in the Environmental Monitor) and that the (next) FEIR report on the results. I leave it to the judgment of the MBTA, however, to decide whether those results warrant a change in the intermediate station analysis, to be presented in the FEIR.

Ridership Projections

The DEIR has explained that four station build out scenarios were used as the basis for modelling ridership. However, the results, in Tables 5.3-1 and -2, and the discussion consider only two alternatives (Alternate 3 and 4), which shows the predicted range of ridership at the intermediate stations for 1996. It is

unclear why the results for Alternate 1 and 2 were not also presented here to understand the effects of unconstrained parking and the inclusion of a regional station on ridership. This information should be included in the FEIR.

The interim service has been operating for several months and ridership has presumably stabilized. The FEIR should evaluate the accuracy of the ridership projections for Worcester based on actual ridership data. If possible, the conclusions drawn from this assessment should be extrapolated to the intermediate station ridership projections to verify that the programmatic design for those stations is sound.

The impact that the interim service has had on other HOV modes, in particular bus service, should be assessed in the FEIR, as per the CAC comment.

Regional Traffic

The DEIR has predicted "at least modest reductions" in traffic volumes on Route 9 and the Massachusetts Turnpike, while access routes to the stations will experience increased traffic during peak hours of travel. The most significant traffic reduction in 1996 is expected on the Mass Pike between Route 128 and Boston (1400 fewer vehicles in the AM peak).

Layover Facilities

The layover facility will consist of new railroad tracks for four, 9-car train sets, internal access driveways, an electrical substation, a 30 foot by 50 foot maintenance building, fencing, lighting, fire hydrants and an employee parking lot. Nighttime storage and train end runs will occur in the layover facility. The site selection process considered certain criteria, primarily size and location near the last station on the line, in order to identify a preferred location. According to the DEIR, none of the 13 potential sites met all the criteria. The preferred alternative (site 8), at the Conrail Yard, MP 43.5 in Worcester, is in a predominantly industrial area.

The City of Worcester, Office of Planning and Community Development and Preservation Worcester prefer the proposed location because it accommodates four tracks, is adjacent to the Amtrak station, is within a mile of Union Station, the area is industrial, and the location provides parking and facilities for

personnel. As suggested by the City, it may also be possible to realign the site to provide a double-ended facility after permanent service is initiated from Union Station.

Because of expected noise, vibration, odor, and air quality impacts, layover facility siting avoids residential areas, wherever possible. However, there is an elderly housing complex, the Mt. Carmel Apartments, located on the north side of Shrewsbury Street, within 300 feet of the centerline of the layover facility. The DEIR predicted that these apartments may be exposed to an Ldn of 70 dBA under worst case conditions. However, no noise mitigation is planned, because the report indicates that mitigation is only necessary when noise impacts reach or exceed 74 dBA Ldn. This conclusion should be explained in terms of ambient noise levels, the applicable noise impact criteria used to draw this conclusion, and the location where the noise impact was measured.

Reducing train idling time is an effective way to limit locomotive noise impacts. The MBTA has minimal ability, however, to control idling in cold weather. Consequently, this mitigation measure would be unreliable. Electric power sources provide an alternative way to control idling noise. However, the report provides no assurances that this alternative source of power will be used for this purpose. Additional discussion of this issue should be provided in the FEIR to better understand existing applications, the potential effectiveness in controlling auxiliary engine noise, and the degree of noise attenuation that could be achieved at sensitive receptors, such as the elderly housing complex.

The results of the pure tone analysis indicate that the DEP guideline, i.e. the peak exceeds each adjacent octave band sound pressure level by more than 3 dB, will be exceeded for the older 1000-series locomotives. The MBTA is purchasing new locomotives, i.e. 1050 series, which will not have as great an impact, but the phase out of the older locomotives is unspecified. Therefore, the FEIR should consider the frequency of use of the noisier locomotives at initiation of service and long-term to more accurately forecast pure-tone exceedances. The FEIR should consider the feasibility of operating only newer train sets.

The site plan of the layover facility, Figure 9.0-1, also shows that the site is being used as an interim station with platforms, a passenger drop-off area, and a 177 parking space lot. The FEIR should explain what will happen to the station facilities after Union Station is developed. As requested by the

City of Worcester, Office of Planning and Community Development, the FEIR should include any plans for future remodelling of the layover facility after Union Station is complete. The FEIR should also specify the noise mitigation measures that will be undertaken during construction of the layover facility. Those described in the DEIR (p. 9-10) seem appropriate, but no commitments have been made.

Rail Line Impacts

As a result of the addition of a double track along a 7 mile segment from Westborough to Worcester, there will probably be additional drainage, wetlands, wildlife, and archaeological resource impacts. The rail embankment widening and fencing will cause impacts too. However, the DEIR indicates that the areas of new disturbances will not be identified until final design. This raises the concern that the public review may not disclose the extent of the project-related impacts to the natural environment because the FEIR is due at about the 60 percent design stage. To the extent possible, these impacts should be described fully in the FEIR and the report should demonstrate that an effort was made to avoid and minimize damage to resource areas. As noted previously, submission of a separate FEIR for issues relating to the rail line and layover facilities will be considered in a NPC after completion of the DEIR review.

The same level of impact analysis should be provided for the inadequate bridges which will be reconfigured, (the Pine Street Bridge in Grafton, and the Route 85 bridge in Southborough). I note that the CAC and the MAPC have raised a variety of questions relating to bridge reconstruction and lowering of the rail line for double-stacked trains that should be addressed in the FEIR. There are also three grade crossings between Framingham and Worcester that will be affected by the additional train operations. Impacts associated with the increased rail service should be explained in the FEIR.

The implementation of the commuter service (20 trains per day) has been predicted to have a noise impact on 6 residences in Grafton, and the expanded service (32 trains per day or 12 additional trains) is expected to impact 92 residences along the corridor (Table 7.3-2), due to increased train speeds as well as an increase in the number of trains. The DEIR has recommended noise barriers, because of the potential effectiveness, and ballast mats to control vibration. At the same time, the DEIR indicates that two percent of the construction costs can be used

for mitigation. Will there be sufficient funding to mitigate the noise and vibration impacts to the desired levels? Have the barriers been found to be cost effective and therefore implementable? In areas that do not appear to meet the cost effective criterion, will noise attenuation measures be proposed for the buildings directly, or will other measures be proposed?

Commenters have raised a concern that 31 trains will be running as late as 1:20 AM (p. 3-45). The FEIR report should be particularly sensitive to nighttime noise impacts and consider ways to control those late night and early morning operations. The FEIR should also respond to concerns expressed by the City of Boston with noise impacts in the Framingham-Boston corridor, and concerns that the noise standards used do not take into account background noise and cumulative impacts.

The DEIR includes an inventory of the expected train vibration impact (Table 7.3-4) to 41 residences. After reviewing the vibration mitigation options, the DEIR concludes that about 4650 feet of ballast mats would be needed to reduce the impact entirely. The report concludes that it may not be cost effective to protect only a few houses, however. Moreover, mats may not be as effective in areas where the vibration is due to low frequency components. The FEIR should clarify the vibration mitigation plan based on further assessment of the areas of impact.

Archaeology and Historical Impacts

Although the main text is quite abbreviated, Appendix I in DEIR is sufficiently complete to understand the work undertaken to identify and remediate archaeological and historical impacts. The results of background research, an architectural windshield survey, an archaeological walkover survey, and predictive modelling to identify the archaeological sensitivity of the sites impacted by the project.

Areas of potential disturbance, with the exception of the bridge work, will not be known until final design, and so the extent of the potential impacts is unclear. The recommended station sites generally are considered potentially significant for archaeological resources; all interim station locations, including Millbury station sites (Route 122, and Route 20), Grafton, Westborough, Southborough, and Ashland are identified for further study.

The DEIR has also recommended a complete architectural survey; however, the recommendations for the work on historical bridge structures remain unclear. This should be addressed in the FEIR. I concur with the suggestions of the Massachusetts Historical Commission (MHC) as to how and when to proceed with surveys and more advanced investigations, and what information should beprovided in the FEIR.

Drainage

The FEIR should provide more detailed information about the required culvert repair work and any new drainage outlets which will result in wetlands impacts. Commitments to the maintenance of the storm drainage system should also be made in the FEIR. What specific measures are needed for the oil drip pans and separators, such as those described for the layover facility (p. 9-11)? Although the description of the systems appears to suggest that these may not be the typical oil separators, the degree of effectiveness has not been predicted.

Station by Station Comments

The following discussion of station impacts is a summary of some of the salient points raised in the comments listed below. I note that comments like those submitted on behalf of the Town of Westborough cannot be easily summarized; as provided in the MEPA regulations, those comments nonetheless require a response in the FEIR. In addition, the Draft Section 61 Finding in the FEIR should itemize the proposed mitigation measures by station location.

Many favorable comments were received for the Southborough station proposal. The Westborough station site appears to be the most controversial, based on the number of issues raised. Many comments advocated for the development of a more regional station, in order to eliminate the localized impacts on some municipalities, particularly the impacts in the Towns of Westborough and Southborough.

The CAC and several commenters have concerns that traffic will be diverted and impacts worsened if adjacent stations are not developed within the same timeframe. This issue needs to be considered in the FEIR.

Agricultural impacts may result indirectly from growth that is induced by expanded commuter rail service. As requested in the comment from the Department of Food and Agriculture, mitigation off-sets for indirect farmland impacts should be considered in the FEIR. According to that agency, several commuter rail stations have the potential to provide marketing opportunities for local farmers.

Bicycle and pedestrian accessibility to and from the proposed stations is an important issue; amenities such as sidewalks, bike paths, lockers, and good travel routes to the station need attention in the FEIR.

Ashland - The CAC comment raises important issues concerning platform alignments and parking availability that need further evaluation.

It appears that the south parking lot access at Route 135 will have a significant impact. The Town of Ashland has recommended widening for designated turn lanes and signalization for safety. This should be evaluated in the FEIR. There are also concerns with the intersections in Ashland that are at levels of service (LOS) D/F. Mitigation measures for these locations should also be considered.

The MetroWest comment supports the east alternative, chosen by Ashland Selectmen because it has the potential to improve the waste site cleanup area, opens areas for commercial and industrial development, has minimal wetland impact, and avoids a grade crossing for some commuters.

There is also comment in support of the Ashland west alternative which indicates that the traffic and noise impacts would be lower and that at grade crossings would be shorter in length. Furthermore, the west alternative avoids potential delays with the Nyanza waste site cleanup. This alternative has the potential for localized business impacts, according to the comment from Daniel Giargiari, which should be addressed in response to the concerns raised.

Millbury - The CAC comment questions some traffic assumptions and results that should be reconsidered in the FEIR. In addition, a drainage system maintenance plan and commitments to fulfill the requirements of the plan need to be clarified in the FEIR.

More traffic mitigation may be needed at Route 122/20, according to commenters, and land taking is a concern. The access road from Route 20 could be developed so as to encourage economic development.

Bicycling and pedestrian access options should be pursued, and a commenter notes that the Route 122 station location is preferable because it is accessible to pedestrians and by bicycle.

Southborough - Commenters indicate that the pedestrian overpass is aesthetically out of character with the neighborhood. As an alternative, reactivation of the existing underpass has been proposed. The compatibility of the station design in the rural business district needs to be shown in the FEIR.

Some have solicited a commitment that a garage will not be built at the proposed Southborough Station and the reservation of 90 spaces on north side for residents only is controversial.

As expected, there are traffic concerns and impacts on the residential character of the area. Closure of the median on Route 9 at Woodland Road has been reported to be held up because of the EIR review for the commuter rail project. It is not clear why this is so. Furthermore, the CAC comment recommends that the proposed signal timing changes at Route 85/Southville Road be reviewed because this measure may not be sufficient to mitigate the traffic impacts.

Westborough - Historical properties have been overlooked according to the comment from the Westborough Historical Commission. Furthermore, archaeological survey data has not yet been provided to the Town or the Massachusetts Historical Commission.

Neighbors have raised concerns about noise impacts on homes and the neighborhood that deserve attention in the FEIR.

There are also concerns with the safety of children who walk on Fisher Street during commuter rush hours. Sidewalks are in poor condition or non-existent; however, according to the CAC, plans for sidewalks are being developed.

Traffic volumes on Milk to Maynard Streets should be higher than indicated in the DEIR, and volumes on Fisher Street appear to be too low also. The traffic assumptions have been questioned

by the CAC, the Town of Westborough municipal agencies and the MBTA Advisory Committee. Background growth does not appear to have been fully accounted for in the study and commuter route distribution has been questioned.

The roadway improvements at the Route 9/Otis Street intersection may not make this the preferred route to the station. A route from Milk Street to Fisher Street, and then to Smith Valve would be more direct, based on comments. Safety issues at the key intersections have not been addressed to the satisfaction of commenters. Streets such as Arch Street are narrow and rural in character. However, these local streets have been impacted to a great degree by the development on Route 9 near Otis Street. These traffic and safety concerns warrant thoughtful consideration in the FEIR.

Grafton - A commenter sees an economic development potential being created in Central Massachusetts by the Grafton Station siting. A reverse commuting pattern could be established because of the linkage opportunity for biotech parks along the rail corridor. The traffic analysis should reconsider station traffic to Green Street in Shrewsbury.

Wellesley - The Town has raised a concern that no impact assessment of the 3 stations in Wellesley has been provided in the DEIR. The Town has specific safety concerns.

Boston - A comment has observed that the DEIR did not provide a study of the potential for a new station at Kenmore Square (Yawkey Way) and its connection to the urban ring. The City of Boston has pointed out that additional information is needed to address pedestrian and platform issues at South Station.

Newton - The Department of Planning and Development has raised the concern that the basic and full build service may cause significant scheduling disruptions on existing services. This may be particularly so at the three stations in Newton because this is a single track service.

March 16, 1995
DATE

Trudy Coxe
Trudy Coxe

Comments received:

10/4/94	Russell Fustino
11/22/94	Office of Selectmen and Town Manager, Town of Ashland
1/6/95	Board of Selectmen, Town of Wellesley
1/6/95 3/8/95	John Woodward
1/8/95	Anne M. Huff
1/10/95	Westborough Historical Commission
1/22/95	Bicycle Coalition of Massachusetts
2/1/95	Brennan F. Wall
2/2/95	Judith and Thomas Little
2/2/95	Andrew and Teresa Boyce
2/5/95	Massachusetts Restaurant Association
2/8/95	Jane Fedorowicz and Michael Golibersuch
2/8/95	William Murphy
2/8/95	Claudia J. Lefter
2/12/95	Scott Rossiter
2/14/95	Joseph Harrington
2/14/95	Patricia C. Pirozzi
2/14/95	James M. Waddell
2/16/95	Medical Academic and Scientific Community Organization, Inc.
2/17/95	Helen and Bill Panas
2/17/95	Brennan F. Wall
2/21/95	Mrs. Paul A. Smith
2/22/95	Elizabeth Colbert
2/23/95	James P. Knowles
2/23/95	Peter Venuto
2/20/95	Joseph P. Orlando
2/20/95	Mary Cullen
2/24/95	City of Worcester, Office of Planning and Community Development
2/24/95	Mary Fisher and Family
2/24/95	Tufts University, School of Veterinary Medicine
2/24/95	Stephen and Charlene Henry
2/26/95	Susan B. Stager
2/27/95	Preservation Worcester
2/27/95	Police Department, Westborough
2/28/95	Ellen L. Giargiari
2/28/95	MAPC
3/3/95	Keith K. Davison
3/4/95	Jane and Richard Dunphy
3/3/95	Burnham's Supper House
3/3/95	Mario Avelloni
3/5/95	Richard E. Fournier, Jr.
3/5/95	Robert L. and Barbara R. M. Brais

3/5/95	Sally Tajiani
3/5/95	Alan Pl and Janice R. Silvestry
3/6/95	Town of Westborough (Selectmen, MBTA Advisory Committee, Planning Board, Police Dept., Public School Committee, Joyce Coll, Lou and Maureen Jankauskas, Ellen Gugel, Barbara Reismann, Barbara Sullivan (and others already cited previously)
3/6/95	Bill and Mary Anne Coveney
3/6/95	E. Thomas and Judith McCabe, et. al
3/6/95	Dorothea E. MacLeod
3/6/95	Jackie Adams
3/6/95	Department of Food and Agriculture
3/6/95	Rosemary Johnson
3/6/95	Town of Ashland, Office of Selectmen
3/6/95	Senator Robert A. Durand
3/6/95	Town of Grafton, Board of Selectmen
3/6/95	Nelson Holden
3/7/95	Marvin S. Silver
3/7/95	MetroWest
3/7/95	Brian and Antoinette Kennedy
3/7/95	Larry Gomes
3/7/95	Department of Planning and Development, City of Newton
3/7/95	Cheryl and Paul Crivello
3/7/95	Town of Framingham, Planning Department
3/7/95	Town of Southborough, Board of Selectmen
3/7/95	Jennifer M. Speed
3/7/95	Diane M. Power
3/7/95	Rep. Harriette L. Chandler
3/8/95	Jacqueline and David Cox
3/8/95	City of Boston, The Environment Department
3/8/95	BRA
3/8/95	People for Ashland West Alternative, John J. Kelly et. al
3/8/95	Massachusetts Audubon Society
3/9/95	Mary Richards, DEP/CERO
3/9/95	Stephen Kerlin, Town of Ashland
3/9/95	Town of Hopkinton, Office of Selectmen
3/9/95	MHC
3/9/95	Senator Matthew J. Amorello
3/8/95,3/9/95	Union Station Alliance
3/9/95	Andrew B. O'Donnell
3/9/95	Ashland MBTA Rail Committee
3/9/95	Massachusetts Biotechnology Research Park
3/9/95	Central Massachusetts Regional Planning Commission

Late comments:

3/10/95	Dorothy McMahon
3/10/95	Julia McTigue Jacobs
3/10/95	Bruce R. Johnson
3/14/95	Thomas R. Hoover, Worcester City Manger

P:9154.dei
TC/NB/nb/jr

Massachusetts Bay Transportation Authority

William F. Weld, Governor | Argeo Paul Cellucci, Lieutenant Governor | James J. Kerasiotes, Secretary and MBTA Chairman | Robert L. Mabardy, Interim General Manager

May 12, 1995

The Honorable Trudy Coxe, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, Massachusetts 02202

Attention: MEPA Unit

Re: Worcester Commuter Rail Extension - EOEA #9154
Notice of Project Change to Prepare Two Separate
Final Environmental Impact Reports (EIRs)

Dear Secretary Coxe:

The Massachusetts Bay Transportation Authority (MBTA) Draft Environmental Impact Report to extend commuter rail service to Worcester was found by you to comply with the Massachusetts Environmental Policy Act and with its implementing regulations on March 16, 1995. The Worcester Rail review is being carried out as a Major and Complicated Project under the control of a Special Procedure. Under the provisions of the Special Procedure, the MBTA is allowed certain discretion in filing multiple Final EIRs for the project. In your recent Certificate, as in the October 8, 1992 Certificate establishing the Special Procedure, you point out the advantages of filing separate and sequential Final EIRs for the project.

Accordingly, we seek by this letter your permission to prepare and file two separate Final EIRs for this project. Under the provisions of the Certificate of the Secretary of Environmental Affairs on the Notice of Project Change dated January 14, 1994, the MBTA initiated interim service to Worcester in September, 1994. While the interim service has been successful in attracting ridership, relatively complicated dispatching has been required along the single track section of the line. It also has been necessary to utilize, on a temporary basis, layover facilities in a Providence and Worcester Railroad Yard in Worcester. Use of this area has resulted in complaints from abutters. To expedite transfer to the permanent layover facility and to simplify dispatching operations, the MBTA proposes to prepare a first Final EIR immediately for the track and other rail corridor improvements and the layover facility.

There remain, however, unresolved questions pertaining to final determination of immediate station locations in the communities between Worcester and Framingham that make preparation of a Final EIR for those elements impractical within the same timeframe as the track improvement/layover facility EIR. The MBTA proposes to treat these matters in a second Final EIR.

The approach just outlined will not cause any inadvertent shift or increase in environmental impacts. Each of the proposed Final EIRs will provide an introductory description of the project as a whole so that context can be maintained. In addition, we suggest below the particular topics to be considered in each document. We hope that you agree with us that this approach will provide for the greatest environmental benefit and offer the greatest opportunity for informed public comment.

PROPOSED TRACK AND LAYOVER FINAL EIR

The first Final EIR is intended to deal with the questions surrounding the permanent layover facility in Worcester and the construction of the rail and signal improvements needed for two-track operation of the line between Framingham and Worcester.

Track/Corridor Improvements

The Draft EIR discussed proposed improvements to the rail corridor necessary to accommodate the combined use by MBTA commuter rail trains, Amtrak passenger service, and Conrail freight. While the major focus of the track bed improvements consists of restoration of a 7-mile section of double track between Westborough and Worcester, an additional 3-mile section of existing track in Worcester must be upgraded for use as a mainline track. Geometric improvements to the remainder of the corridor, to allow for increased speed limits, and measures to increase overhead clearances at several bridges also were discussed. Operational and safety issues such as signal and communication system upgrades and fencing also were described.

Very few of the comments received on the Draft EIR concerned these aspects of the project. Subsequent to circulation of the Draft EIR, as design progressed on corridor improvements, it was determined that an additional 1.5 miles of storage track is necessary immediately west of Union Station in Worcester to replace storage track being upgraded for mainline use east of Union Station. Construction of this storage track in an urban setting is not expected to involve work outside the right-of-way, nor to lead to adverse environmental effects. The MBTA plans to include a discussion of the effects of this additional work within the scope of the Final EIR for the Track and Layover Facility. The reconstruction of the Route 85 railroad bridge in Southborough will be included also.

Layover Facility

The Draft EIR presented a thorough discussion of the layover site selection process and evaluation criteria resulting in the choice of a preferred site. The Draft EIR also presented an overview of the facility layout, including new trackage, access driveways, electrical substation, maintenance building, and site drainage. Potential impacts of the layover facility operations were addressed, including traffic, air quality, noise and vibration, drainage and hazardous materials, and possible short-term impacts from construction. Mitigation options were set forth where appropriate.

Comments received on the Draft EIR expressed concerns regarding noise and vibration, the possibility of additional track alignment alterations after renovation of Union Station is completed, access and parking questions, and mitigation matters.

The Final EIR will carry forward the Draft EIR discussions of the track and corridor improvements and the layover facility, report on any changes in design or anticipated effect since the Draft EIR was reviewed, and set forth the MBTA's proposed mitigation of any unavoidable impacts.

Response to Comments

The response to comments section of the Track and Layover Final EIR will address each comment raised about these matters in the Draft EIR Certificate, in the CAC's Draft EIR comments, and in the additional comments submitted.

PROPOSED RAIL OPERATIONS/STATION CONSTRUCTION EIR

The second Final EIR is intended to address all remaining questions other than those dealt with in the Track and Layover Final EIR. The key areas are the projections of ridership for basic service, the noise and vibration effects of rail operations, and station siting and construction questions.

Rail Operations

The primary focus of this section of the second Final EIR will be on the elements of, and potential impacts from, the implementation of the basic service commuter train schedule presented in the Draft EIR. The impact from noise and vibration will be further assessed and, where appropriate, mitigation will be proposed. The MBTA will provide a further discussion of its financial capability to operate this service without adversely affecting its services elsewhere. Additional light will be shed on existing transportation networks and mode choice factors. The MBTA has had the opportunity to assess the impact of interim service on other HOV modes and will present these data along with any needed additional evaluation of ridership projections in the Final EIR.

Station Construction

The MBTA is continuing to work with CAC and representatives of the five communities in which intermediate stations are proposed to finalize site selection. The Draft EIR presented impact analyses for fixed station locations (in Grafton, Westborough, and Southborough) and for stations which have alternative sites (in Millbury and Ashland). With the filing of this Final EIR, a firm presentation will be made on the number and location of stations to be built and specific details of each station will be provided. The Final EIR will include a station by station discussion of potential environmental impacts and proposed mitigation. Potential archaeological, historical and agricultural impacts also will be examined. A timeframe and sequencing for station construction will be presented, having as its goal a smooth transition from interim to basic service. Concerns have been expressed in Draft EIR comments that traffic patterns could be adversely affected if adjacent stations are not developed in the same timeframe. Traffic patterns will be addressed by the MBTA in the Final EIR on a station by station basis.

Regional Station Analysis

The Legislature directed the MBTA to complete a report on a regional station as part of the recently passed Transportation Bond Bill. To respond to this requirement, the MBTA will engage an independent consultant to assess the potential for, costs of, and benefits of a regional station in the vicinity of Route 9 and I-495. The operations/stations Final EIR will summarize the results of this report. The MBTA will, as it has in the past, carefully consider the concerns and arguments raised about a regional station during this and other reviews and will discuss the ongoing regional station analysis with the CAC.

Response to Comments

For this second Final EIR, a response to comments section will address comments, other than those on track and layover matters, raised in the Draft EIR Certificate, in the CAC's Draft EIR comments, and in additional comments submitted. Here, however, given the bulk of comments and the similar subject matter of many of them, the MBTA proposes to prepare a consolidated "Response to Commonly Raised Questions" as a part of the response to comments chapter. If this is acceptable, most comments can be dealt with effectively and without repetition. We also propose to use an index table to direct commenters to responses in the body of the text and to respond directly to singular comments that are not dealt with in the response to commonly raised questions or elsewhere in the text.

PROCEDURAL MATTERS

The lapse of time since the drafting of the original Special Procedure, the experience gained by the MBTA in the review to date, the sheer bulk of the comments on the Draft EIR, and the fall off in attendance at Citizens' Advisory Committee meetings, together lead the MBTA to request three procedural changes. We propose to: broaden and revivify the CAC; circulate the comments on the Draft EIR once instead of twice; and provide a review period appropriate to the scale of each of the two proposed Final EIRs.

Citizens' Advisory Committee (CAC)

Comments from Hopkinton and from Framingham have requested that each be granted a seat on the CAC. The MBTA has no objections to this request and asks that the Secretary consider inviting each community to designate a representative. Simultaneously, the other communities on the CAC might be asked to confirm their designee or make a new designation so that those members who either have lost interest or no longer have the time to participate may be replaced by more active community representatives.

Distribution of Draft EIR Comments

Given the bulk of the commentary received on the Draft EIR--some 500 pages--the MBTA seeks your permission to distribute the entirety of the comments one time, with the Final EIR on Operations and Stations, to all commenters and interested parties on the circulation list. The comments on the track work and the layover facility are sufficiently few that they can be abstracted and quoted directly in the Response to Comments section of the Track and Layover Final EIR. These responses then can be incorporated into the index table that will accompany the Operations and Stations Final EIR so that a complete response to comments can be had in one document.

Filing Schedule and Review Periods

The MBTA anticipates filing the Track and Layover Final EIR with MEPA in May or June, 1995, and requests a public comment period of thirty (30) days. Current expectations are to file the Rail Operations and Station Construction Final EIR by the end of this year. A sixty (60) day public comment period will be requested.

CONCLUSION

The MBTA looks forward to your consideration of and favorable action on this request, and stands ready to respond to any questions that you might have or to consult with you and other interested parties on this proposed way of going forward. Please telephone Andrew Brennan at 617-722-3126 if you need further information, or if consultation is needed.

Sincerely,

Robert L. Mabardy
Interim General Manager

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, 02202

WILLIAM F. WELD
GOVERNOR
ARGEO PAUL CELLUCCI
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TRUDY COXE
SECRETARY

Tel: (617) 727-9800
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June 22, 1995

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE NOTICE OF PROJECT CHANGE

PROJECT NAME	:	Worcester Commuter Rail Extension
PROJECT LOCATION	:	Statewide
EOEA NUMBER	:	9154
PROJECT PROPONENT	:	Massachusetts Bay Transportation Authority (MBTA)
DATE NOTICED IN MONITOR	:	May 23, 1995

Pursuant to the Massachusetts Environmental Policy Act (M.G.L. c. 30, ss. 61-62H) and Section 11.17 of the MEPA regulations (301 CMR 11.00), I have reviewed the Notice of Project Change (NPC) submitted on the above project, and hereby approve the requested change in the Special Procedure for environmental impact review. The Special Procedure was developed for the Worcester Commuter Rail Extension Project in October 1992, pursuant to the MEPA regulations' provisions for designation of Major and Complicated projects. The NPC was filed in accordance with that procedure and in response to the March 16, 1995 Certificate on the Draft Environmental Impact Report (DEIR).

In the NPC, the MBTA requests permission to prepare and file two separate Final Environmental Impact Reports (FEIRs). The first FEIR would focus on proposed track and corridor improvements and on a permanent layover facility in Worcester. The second FEIR would address all remaining issues, and would include sections on rail operations, station siting and construction, alternatives, ridership, revenue issues, and the feasibility of a regional station. The NPC also requests the redesignation of Citizens' Advisory Committee (CAC) members (and the addition of representatives from Hopkinton and Framingham), a single distribution of comments on the DEIR, and a sixty day review period for the Rail Operations and Station Construction FEIR.

Final Environmental Impact Reports

The MBTA presents convincing reasons for filing two separate and sequential FEIRs. The March 1995 DEIR Certificate included a scope for both FEIRs. The MBTA's approach to addressing that scope, as discussed in the NPC, generally is satisfactory. Because the Operations/Station FEIR is intended to address any issues that are outstanding after the submittal of the Track/Layover Facility FEIR, the Certificate on the Track/Layover Facility FEIR will summarize remaining concerns that must be addressed in the Operations/Station FEIR. The Operations/Station FEIR also must include a response to comments on the Track/Layover Facility FEIR (and to the comments received on the current NPC), as well as the main response to comments on the DEIR (see "Procedural Matters", below).

Since the review of the DEIR, the MBTA has identified the need for an additional 1.5 miles of storage track west of Union Station in Worcester. This track was not included in the DEIR, and should be fully analyzed in the Track and Layover Facility FEIR. The reconstruction of the Route 85 railroad bridge in Southborough also should be included in that document.

The NPC proposes to include a summary of the report to the Legislature on the feasibility of a regional station in the Operations/Station FEIR. In the Certificate on the DEIR, I requested that the full report be made available for public comment through a notice in the Environmental Monitor. I reiterate that request, and encourage the MBTA to take account of public comment before it makes a final decision concerning the location of intermediate stations.

The Operations/Station FEIR should include a separate chapter that summarizes mitigation measures for the entire project. That chapter must include a Draft Section 61 Finding for all state permit areas. The Draft Section 61 Finding should contain clear commitments to mitigation, an estimate of the cost and funding source for each proposed mitigation measure, identification of the parties responsible for funding and/or implementing each measure, and a schedule for implementation of the mitigation.

Procedural Matters

Citizens' Advisory Committee (CAC). The CAC, which was appointed in 1992, includes representatives from the towns of Ashland, Grafton, Millbury, Southborough, Westborough, and the City of

Worcester, as well as designees of several transportation and planning organizations. The CAC has provided valuable assistance to me in the review of previous project documents, and I thank its members for their efforts.

Given the length of time that the CAC has had to work on this project, and the amount of effort that will be required in the FEIR phase, it seems appropriate to update membership. I will be asking the communities and organizations that have CAC representatives to either confirm their current designees or nominate new members in the next few weeks. In addition, I will expand the CAC membership to include representatives from Framingham and Hopkinton. A notice will be placed in the Environmental Monitor concerning the redesignation process. The current CAC will continue to operate until the redesignated CAC is appointed.

Distribution of Draft EIR Comments. Over 500 pages of comments from nearly 100 individuals and organizations were received on the DEIR. Most of these comments concerned station and operational issues, with relatively few discussing potential track and layover facility impacts. Because of the volume of comments, the MBTA has requested permission to distribute the DEIR comments and the full response to comments only with the Operations and Stations FEIR. Comments that are specific to the track and layover facility would be included in the first FEIR. I agree that a single distribution of comments makes sense in this case, and therefore grant permission to the MBTA to proceed in the manner described in the NPC.

Filing Schedule and Review Periods. The MBTA indicates that it will request an extended comment period of 60 days for the Operations and Stations FEIR, with a standard 30 day comment period for the Track and Layover FEIR. Given the intensity of interest concerning operations and station issues, the extended review period for the second FEIR is appropriate. At the current time, the MBTA anticipates that the first FEIR will be filed in the summer of 1995, with the second FEIR to follow at the end of the year.

June 22, 1995
DATE

Trudy Coxe
Trudy Coxe

Comments received : Framingham Planning Department, 6/12/95
TC/JGH/jh

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, 02202

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September 14, 1995

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE FINAL ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	:	Worcester Commuter Rail Extension (Railroad Right-of-Way and Layover Facility)
PROJECT LOCATION	:	Statewide
EOEA NUMBER	:	9154
PROJECT PROPONENT	:	Massachusetts Bay Transportation Authority (MBTA)
DATE NOTICED IN MONITOR	:	August 8, 1995

The Secretary of Environmental Affairs hereby determines that the Final Environmental Impact Report submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (M.G.L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The Worcester Commuter Rail Extension project is being reviewed by MEPA under a Special Procedure, in accordance with the MEPA regulations' provisions for Major and Complicated projects. In June of 1995, the MBTA received permission to prepare and file two separate Final Environmental Impact Reports for the project. The first would focus on proposed track and corridor improvements and on a permanent layover facility in Worcester. The second would address all remaining issues (including rail operations, station siting and construction, alternatives, ridership, revenue issues, and the feasibility of a regional station) and would provide a response to comments on the first FEIR. Today's Certificate covers the first of the two FEIRs.

Layover Facility

The preferred site for the permanent layover facility is the Conrail Yard in Worcester (Site 8). Thirteen alternatives were analyzed in the DEIR, none of which met all the MBTA's siting criteria. Site 8 was selected because it was near the proposed

permanent commuter rail terminal station and the current interim station, had few apparent environmental issues, and was located in an active rail area with primarily non-sensitive adjacent land uses.

Because the extended or overnight idling of locomotives is the primary source of noise and air quality impacts at a layover facility, the MBTA has committed to installing electrical plug-in power sources to reduce the amount of idling time to a minimum. Another factor in determining the level of impacts is the type of locomotive that is used. About one-third of the MBTA's current fleet of locomotives are an older model (Series "1000") that produces more pollutants and noise (including "pure tone" noise) than the newer locomotives. With the planned addition of 26 new locomotives (and the retirement of the older vehicles over the next decade), the 1000 series will account for less than one-fourth of the fleet. For purposes of impact analysis, it was assumed that one locomotive in four at the layover facility would be the older model.

The major concern with the proposed layover facility was potential impacts on the Mt. Carmel apartments, a housing complex for the elderly located about 260 feet north of the layover site.[1] The FEIR analyzed whether the construction and operation of the layover facility would have adverse air quality, noise or vibration[2] impacts on the residents of the apartments. Using the assumptions that overnight electrical power would be provided and that one-fourth of the locomotives would be the older model, the FEIR found that the layover facility would have minimal impacts in terms of air quality and induced vibration, and some noise impact.

Carbon monoxide (CO) and nitrogen dioxide (NO_2) emissions from vehicles using the commuter parking lot and from the locomotives were modelled for the FEIR. Predicted 1-hour levels of CO at the Mt. Carmel apartments ranged from 4.7 ppm to 3.8 ppm (including an ambient level of 3.0 ppm), compared to a maximum 1-hour standard of 35 ppm. Eight hour levels were estimated to be

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[1] The Mt. Carmel apartments and Our Lady of Mt. Carmel Church are the nearest sensitive receptors to the site.

[2] When trains are idling or travelling at low speeds, vibration impacts are most often caused by low frequency "pure tone" noise that induces vibration in building components, rather than by direct ground-borne vibration.

between 3.3 ppm to 2.7 ppm (with a background level of 2.0 ppm), compared to the 8-hour standard of 9 ppm. Somewhat higher levels were estimated for the sidewalks between the apartments and Shrewsbury Street; however, these also were well below the standards. A preliminary analysis of NO_2 levels indicated that there would be a slight increase in NO_2 at the apartments under worst case conditions in the morning; that increase would not result in a violation of air quality standards. I note that recent advances in technology (such as afterburners and new locomotives that have emission rates even lower than the newer vehicles in the MBTA's fleet) have the potential to reduce locomotive emission levels. The MBTA should consider the retrofitting of older locomotives and the purchase of the newest models in order to minimize train emissions.

In the FEIR, there is an analysis of "pure tone" noise, i.e. peaks in the sound frequency spectrum at one or more discrete frequency bands, produced by the different locomotives in the MBTA's fleet. Pure tones, especially those at low frequencies, can cause building vibration and an annoying "throbbing" sound even when the A-weighted sound level is low. The analysis shows that the older 1000 series locomotives violate DEP's noise policy for pure tones, while the newer vehicles do not. However, the frequency of the pure tones produced by the 1000 series locomotives is above the low frequency range that can cause vibration, which reduces impacts somewhat. For operational and scheduling reasons, the MBTA believes it is not feasible to restrict the use of the older locomotives on the Worcester line (which would be the most effective way to avoid impacts from pure tone noise). However, I urge it to investigate any other means that can be implemented to minimize or mitigate such impacts.

The Mt. Carmel apartments are located next to an exit ramp from Interstate Route 290, in an area of high ambient noise (76 dBA L_{dn}). Based on Federal Transit Administration (FTA) criteria for noise impacts on residential land uses, an increase of 0.5 dBA L_{dn} or more would be considered to be an "impact", and an increase of 2 dBA L_{dn} or more would be a "severe impact".[3] Under the "best case" scenario (all new locomotives), the increase in noise at the Mt. Carmel apartments would be less than 0.5 dBA L_{dn}. However, the increase under the "baseline" scenario (one-fourth older locomotives) would be 1 DBA L_{dn}. Under current guidelines used by the MBTA (and which are based on FTA standards),

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[3] Under FTA standards, very little additional noise is allowable in areas of high ambient noise.

increases in noise that cause a property to fall in the "impact" range only need to be mitigated if the increase over ambient conditions is 5 dBA or more. Nevertheless, consideration should be given to measures that can reduce noise impacts to the "no impact" level.

I find that the FEIR adequately addresses the issues concerning the layover facility that were raised in the Certificate on the DEIR. The primary concern was about noise impacts, and the noise analysis was revised and expanded in the FEIR, and mitigation measures were formulated.

The major mitigation measure that is being proposed by the MBTA to address noise and air quality impacts (the provision of electrical power to minimize engine idling) has been incorporated into the FEIR impact analyses. Without that measure, noise exposure at the Mt. Carmel apartments could be expected to increase by 8 to 10 dBA L_{dn}, clearly an unacceptable situation. Through its commitment to providing overnight electrical power the MBTA has been able to reduce potential impacts from layover operations significantly. I note that the FEIR mentions that an additional measure is planned (the provision of an air compressor to maintain brake pressure overnight) that will reduce morning locomotive idling time, and possibly further reduce noise and air impacts. A commitment to that measure should be included in the section on mitigation and the Draft Section 61 Finding that will be part of the Operations/Stations FEIR, as well as any other measures that are developed by the MBTA.

Railroad Right-of-Way

The FEIR generally has evaluated the impacts that are related to the construction of the railroad right-of-way in an adequate manner. However, there are several areas where additional analysis is required. The major areas that need further clarification include historic and archaeological resources, and vibration impacts. The Special Procedure for this project was set up to allow unresolved issues from the first FEIR to be further addressed in the second FEIR, and I expect that the proponent will do so.

The second FEIR must fully address the concerns of the Massachusetts Historical Commission. Summary results from the intensive survey for the second railroad track must be included. If possible, that information should be provided to MHC before the completion of the FEIR, so that its recommendations for

avoiding, minimizing or mitigating impacts can be incorporated into the document. I note that the MHC has found the building and bridge inventory forms that were provided by the proponent to be incomplete and inadequate. The MBTA and its cultural resources consultant should meet with MHC staff as soon as possible to correct these deficiencies.

An evaluation of vibration impacts was included in the right-of-way FEIR because some potential mitigation measures would affect the construction of the rail bed, and therefore could have secondary environmental impacts. The FEIR found that there would be annoyance-level vibration impacts on 19 residences, but all impacts would be below the level that would cause structural damage. Because of the low frequency content of the vibration that the commuter rail trains produce, potential path vibration control treatments (such as ballast mats) would be largely ineffective, and are not being proposed. The only vibration mitigation measure being proposed is to regularly maintain train wheels and trackbed.

More detailed information should be provided concerning vibration impacts on the 19 residences. This should include a description of the magnitude of impact on each structure, so that the effectiveness of alternative mitigation strategies can be better evaluated. The feasibility and effectiveness of strategies such as reduction of train speeds, building acquisition, or purchase of vibration easements should be discussed in detail.

I note the concerns of the CAC about the possibility that vibration impacts will be greater than described in this FEIR if some or all of the intermediate stations are not built. If assumptions concerning the number or location of intermediate stations change, the vibration analysis must be revised. Other issues that the CAC has raised, including vibration impacts on commercial land uses such as restaurants, should also be addressed.

A number of comments were received concerning the Route 85 bridge in Southborough. There is a difference of opinion among the MBTA, the MHD, and the Town of Southborough whether the bridge clearance should be raised, and if so, to what height. This issue is relevant to this office only to the extent that the bridge design impacts environmental resources. The MBTA, MHD and the Town should continue their discussions, and try to resolve their differences. If the bridge height that is selected differs from that described in the right-of-way FEIR, an analysis of its environmental impacts should be included in the second FEIR.

DEP notes that a number of its comments on the DEIR were not fully addressed in the right-of-way FEIR. Those comments must be addressed in the Operations/Stations FEIR (along with all remaining comments on the DEIR). In addition, DEP's comments concerning application of herbicides near public water supplies (as well as municipal water supplies) should be noted, and the plans or maps that they request should be included in the second FEIR.

Miscellaneous

Information on alternatives, ridership, and revenue issues has been included in this FEIR in order to explain the project's background. That information also will be provided in the second FEIR, at which time it will be fully reviewed by this office.

Finally, it has been brought to my attention that track work has been occurring in the Worcester rail corridor. The proponent has assured me that this work is being conducted by Conrail, and is not part of this project. The MBTA is aware that all environmental analysis that is required under MEPA must be adequately completed before construction of this project can begin.

September 14, 1995
Date

Trudy Coxe

Comments received : DEP/CERO, 8/31/95
Worcester OPCD, 8/31/95
CAC, 9/5/95
MHC, 9/6/95
Southborough Selectmen, 9/6/95
L. Bogar, 9/6/95
MHD, 9/7/95
K. Davison, 9/7/95

TC/JGH/jh

Massachusetts Bay Transportation Authority

William F. Weld
Governor

Argeo Paul Cellucci
Lieutenant Governor

James J. Kerasiotes
Secretary and MBTA Chairman

Patrick J. Moynihan
General Manager

October 31, 1995

The Honorable Trudy Coxe, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, Massachusetts 02202

Attention: MEPA Unit

Subject: Worcester Commuter Rail Extension
EOEA #9154 Notice of Project Change
to Prepare Separate Final Environmental
Impact Reports (EIRs) for Stations

Dear Secretary Coxe:

The Massachusetts Bay Transportation Authority (MBTA) Draft Environmental Impact Report (EIR) to extend commuter rail service to Worcester was found by you to comply with the Massachusetts Environmental Policy Act and with its implementing regulations on March 16, 1995. The Worcester Rail review is being carried out as a Major and Complicated project under the control of a Special Procedure. Under the provisions of the Special Procedure, the MBTA is allowed certain discretion in filing multiple Final EIRs for the project subject to your concurrence.

Our previous Notice of Project Change, dated May 12, 1995, requested permission to prepare and file two separate Final EIRs -- the first for railroad right-of-way (track improvements) and the layover facility and the second for railroad operations and stations. Your Certificate, dated June 22, 1995, approved this procedure. The first Final EIR covering track and layover was submitted on July 31, 1995, and you found it to be in compliance by your Certificate of September 14, 1995.

We seek by this letter your permission to prepare and file two further Final EIRs in lieu of one Final EIR for railroad operations and stations; these will cover all remaining issues noted in your Certificate on the previous Notice of Project Change and in your Certificate on the track and layover Final EIR. This request is prompted by the unresolved issues pertaining to final determination of station locations in Ashland, Southborough, and Westborough, especially pertaining to their interaction around ridership and traffic and the need to address these three stations simultaneously with reconsideration of a possible regional station.

At this time, it appears that only the Grafton Station located off Pine Street and the Millbury Station located off Route 20 (in Worcester) are ripe for a Final EIR, hereafter called the second Final EIR, in order to provide basic commuter rail service (ten trains inbound and ten trains outbound, daily) to area commuters. When outstanding questions are resolved, the third Final EIR will be prepared for the stations the MBTA still plans in Ashland, Southborough and Westborough.

Each of the proposed Final EIRs will provide an introductory description of the project as a whole so that context can be maintained. In addition, we suggest below the particular topics to be considered in each document. We hope you agree with us that this approach will provide for the greatest environmental benefit and offer the greatest opportunity for informed public comment.

PROPOSED RAILROAD OPERATIONS/MILLBURY & GRAFTON STATIONS FINAL EIR

The second Final EIR is intended to deal with the likely impacts associated with the construction and operation of the Millbury and Grafton Commuter Rail Stations and the potential impacts between Worcester and Framingham associated with the expansion of commuter rail service from the present three round trips daily (interim service) to ten round trips daily (basic service). Other subjects will include response to the Secretary's Certificate and to comments by the CAC and others on the November 1994 Draft EIR, and response to the Secretary's Certificate and to comments by the CAC and others on the July 1995 Final EIR for the railroad right-of-way and layover facility, as each of these bear on the Millbury and Grafton Stations and basic service operations.

<u>Rail Operations</u>

The primary focus of this section of the second Final EIR will be on the elements of and potential impacts from basic service commuter train service presented in the Draft EIR. The impact from noise and vibration will be further assessed and, where appropriate, mitigation will be proposed. This analysis will include the effects of increased train speed without the Westborough, Southborough, and Ashland Stations. The MBTA will provide a further discussion of its financial capability to operate this service without adversely affecting its services elsewhere. Additional light will be shed on existing transportation networks and mode choice factors. The MBTA has had the opportunity to assess the impact of interim service on other HOV modes and will present these data along with any needed additional evaluation of ridership projections in the Final EIR.

Station Construction

The MBTA is continuing to work with CAC and representatives of the five communities in which intermediate stations are proposed to finalize station sites. The Draft EIR presented impact analyses for fixed locations (in Grafton, Westborough, and Southborough) and for stations which have alternative sites (in Millbury and Ashland). With the filing of the second Final EIR, a firm presentation will be made on the Millbury Station for which the Route 20 site is preferred, and the Grafton Station at Pine Street. The Final EIR will include proposed mitigation. Potential archaeological, historical, and agricultural impacts also will be reexamined. A time frame and sequencing for station construction will be presented, having as its goal a smooth transition from interim to basic service.

Response to Comments

For this second Final EIR, a response to comments section will address comments, other than those on track and layover matters and for the Westborough, Southborough, and Ashland Stations, raised in the Draft EIR Certificate, in the CAC's Draft EIR comments, and in additional comments submitted. Here, however, given the bulk of comments and the similar subject matter of many of them, the MBTA proposes to prepare a consolidated "Response to Commonly Raised Questions" as a part of the response to comments chapter. If this is acceptable, most comments can be dealt with effectively and without repetition. We also propose to use an index table to direct commentors to responses in the body of the text and to respond directly to singular comments that are not dealt with in the response to commonly raised questions or elsewhere in the text. This index will be updated and completed in the third Final EIR.

PROPOSED WESTBOROUGH, SOUTHBOROUGH AND ASHLAND COMMUTER RAIL STATIONS FINAL EIR

The third Final EIR is intended to address impacts and mitigation measures associated with the construction of rail stations in Westborough, Southborough, and Ashland. Other subjects which might be carried forward from the first Final EIR covering the railroad right-of-way and layover facility and/or from the second Final EIR detailed above will be addressed as necessary. Included among these will be the noise and vibration effects of the three intermediate station stops not considered in the second Final EIR.

Regional Station Analysis

The Legislature directed the MBTA to complete a report on a regional station as part of the recently passed Transportation Bond Bill. To respond to this requirement, the MBTA has engaged an independent consultant to assess the potential for, costs of, and benefits of a regional station in the vicinity of Route 9 and I-495. The third Final EIR will summarize the results of this report. The MBTA will, as it has in the past, carefully consider the concerns and arguments raised about a regional station during this and other reviews and will discuss the ongoing regional station analysis with the CAC. These topics will bear directly on the proposed stations in Westborough, Southborough, and Ashland and therefore, are proposed to be covered in the third Final EIR.

FILING SCHEDULE AND REVIEW PERIODS

The MBTA anticipates filing the second Final EIR with MEPA in January 1996 and requests a public comment period of sixty (60) days. The third Final EIR will be filed once we receive clear direction from the involved municipalities as to their commitment to stations.

COMMENCEMENT OF CONSTRUCTION

In the "Miscellaneous" Section of the September 14, 1995 Certificate on the Track and Layover Final EIR, you commented on work being done prior to finishing environmental review. The work being discussed is, in fact, being done by Conrail, as the owner of the line and is separate and apart from the MBTA project.

The MBTA is interested in going into construction on portions of work for which environmental review is complete, that is, the track and layover. This work must be started before the end of the 1995 construction season in order to maintain our S.I.P. commitment of revenue service by December 31, 1996. We believe going forward on this portion is fully consistent with the original intent of the "Major and Complicated" designation in the certificate on the Major and Complicated designation. Secretary Susan F. Tierney indicated that "... if it appears that there is an opportunity to proceed with certain elements of the project, then the MBTA may opt to file an FEIR for the elements where the analyses are complete." (EOEA No. 9154 Special Procedure Certificate October 8, 1992, page 3.) Earlier, the Secretary wrote " ...I believe that early commencement of this project, or portions of the project, may have positive impacts on air quality, by reducing the number of vehicle miles of travel in the Commonwealth, and by reducing the demand for parking in congested urban areas." (Ibid, page 2.)

The decision to apply for a Major and Complicated designation was clearly done with an eye toward commencing portions of this project earlier than others. Separating the sections does not in any way violate the intent of MEPA, since the track and layover are clearly separate and discreet portions of the project, each of which can stand independently.

By way of this Notice of Project Change, we seek clarification as to whether or not portions, such as the track and layover, for which MEPA review is complete, can proceed with construction.

CONCLUSION

The MBTA looks forward to your consideration of a favorable action on this request, and stands ready to respond to any questions that you might have or to consult with you and other interested parties on this proposed way of going forward. Please telephone Andrew Brennan , MBTA Manager of Environmental Affairs, at 617-222-3126 if you need further information, or if consultation is needed.

Sincerely,

Patrick J. Moynihan
General Manager

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, 02202

WILLIAM F. WELD
GOVERNOR
ARGEO PAUL CELLUCCI
LIEUTENANT GOVERNOR
TRUDY COXE
SECRETARY

Tel: (617) 727-9800
Fax: (617) 727-2754

January 10, 1996

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
NOTICE OF PROJECT CHANGE

FILE COPY

PROJECT NAME	:	Worcester Commuter Rail Extension
PROJECT LOCATION	:	Statewide
EOEA NUMBER	:	9154
PROJECT PROPONENT	:	Massachusetts Bay Transportation Authority (MBTA)
DATE NOTICED IN MONITOR	:	November 7, 1996

Pursuant to the Massachusetts Environmental Policy Act (M.G.L. c. 30, ss. 61-62H) and Section 11.17 of the MEPA regulations (301 CMR 11.00), I have reviewed the Notice of Project Change (NPC) submitted on the above project, and hereby approve the requested change in the Special Procedure for environmental impact review.

The Special Procedure was developed for the Worcester Commuter Rail Extension Project in October 1992, pursuant to the MEPA regulations' provisions for designation of Major and Complicated projects. A Draft Environmental Impact Report (DEIR) was filed in November 1994 and was certified as adequate in March 1995. By a Certificate dated June 22, 1995, the Special Procedure was amended to permit the filing of two separate Final Environmental Impact Reports (FEIRs). The first FEIR, which looked at issues concerning track and corridor improvements and a permanent layover facility in Worcester, was certified as adequate on September 14, 1995. The second FEIR was to address all remaining issues (including rail operations, station siting and construction, alternatives, ridership, revenue issues, and the feasibility of a regional station) and provide a response to comments on the DEIR and the first FEIR.

In the current NPC, the MBTA requests permission to address the issues originally planned for inclusion in the second FEIR in two separate FEIRs. This request was prompted by unresolved issues pertaining to final determination of station locations in Ashland, Southborough, and Westborough. In addition, in a Notice of Project Change that was submitted on the Framingham Terminal Development (EOEA #10106) on November 30, 1995, the MBTA asked to transfer the discussion of environmental issues associated with

that project to the Worcester Commuter Rail Extension project.[1] As it is uncertain when the siting of the three stations to the west of Framingham will be decided, I agree that it is appropriate to proceed with the analysis for railroad operations, and the Millbury, Grafton and Framingham stations, with the FEIR for the Ashland, Southborough and Westborough stations to follow at a later date.

Railroad Operations/Millbury, Grafton and Framingham Stations FEIR

This FEIR should focus on the impacts associated with the construction and operation of the Millbury and Grafton station; operation of the Framingham station and expansion of parking facilities; and expansion of commuter rail service from the interim level (three round trips per day) to basic service (ten round trips per day). It also must address the issues that were identified in the review of the November 1994 Draft EIR, the July 1995 FEIR on the track improvements and layover facility, the December 1995 Notice of Project Change on the Framingham Terminal Development, and the current Notice of Project Change as they relate to the Millbury, Grafton and Framingham stations and to basic rail service.

Major issues to be evaluated include noise and vibration, historic and archaeological resources, and agricultural resources. Sections also should be provided on alternatives, ridership, impacts on other transportation modes, and revenue/financial capability issues. I find the MBTA's proposal to prepare a consolidated "Response to Commonly Raised Questions" to address repetitive comments, along with an index table to direct readers to responses in the FEIR text is an acceptable method to deal with the large number of comments that have been received.

Ashland, Southborough and Westborough Stations FEIR

This FEIR should address any issues that remain from any of the previous EIR or NPC reviews, and summarize mitigation

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[1] That request was granted in a Certificate also issued today. As the NPC for the Framingham Terminal was filed after the NPC for the Worcester Commuter Rail Extension, issuance of this Certificate was postponed in order to coordinate the two decisions.

measures proposed for the entire project. The focus of the report will be on the impacts of the construction and operation of the proposed rail stations at Ashland, Southborough and Westborough. The MBTA also proposes to include a summary of the report to the legislature on the feasibility of constructing a regional station.

Construction of Layover Facility and Track Improvements

The Certificate that set up the Special Procedure for the Worcester Commuter Rail Extension anticipated that the MBTA might want to proceed with elements of the project for which analysis was complete (assuming that those elements would not preclude or presuppose the implementation of additional project alternatives), and prepare separate FEIRs and Section 61 findings for those elements. This has, in fact, occurred. In the current NPC, the MBTA asked for clarification of the conditions under which they might begin construction of the project elements that were analyzed in the first FEIR, which covered track improvements and the permanent Worcester layover facility.

At the time that the FEIR on the Permanent Layover Facility and Track Improvements was certified as adequate, there were some unresolved issues concerning potential archaeological resources in the area to be impacted by the track improvements. Since then, the MBTA has met with the Massachusetts Historical Commission to resolve those issues, and has prepared a Section 61 Finding for the elements covered in the first FEIR that describes its mitigation commitments. Given those commitments, I find that the parts of the project that were analyzed in the Track and Layover FEIR may proceed.

Filing Schedule and Review Periods.

The MBTA indicates that it will request an extended comment period of 60 days for the Operations/Millbury, Grafton and Framingham Stations FEIR. Given the intensity of interest concerning operations and stations, the extended review period for that FEIR is appropriate. At the current time, the MBTA anticipates that it will be filed early this year. The scheduling for the Westborough, Southborough and Ashland Stations FEIR is uncertain.

Citizens' Advisory Committee (CAC)

The communities and organizations that are participating in the CAC have been asked to confirm their current designees or nominate new members, and the Towns of Hopkinton and Ashland have been requested to nominate representatives for the first time. Most of those individuals who were designated by the municipalities and organizations represented on the CAC are current members or have been attending CAC meetings, and I am pleased at their continuing interest in assisting with this important project. A list of my appointments to the CAC is attached to this Certificate.

January 10, 1996
DATE

Trudy Coxe

Comments received : Sen. Matthew Amorello, 11/6/95
City of Worcester OPCD, 11/14/95
MHC, 11/16/95

TC/JGH/jh

Worcester Commuter Rail Extension
Citizens' Advisory Committee
January 10, 1995

Dexter Malone (Ashland)	179 Cordaville Rd., Ashland 01721
Shaun Finnegan (Ashland)	26 Voyagers Lane, Ashland 01721
Frank Healey (Ashland)	54 Sudbury Rd., Ashland 01721
John Stasik (Framingham)	15 Chouteau Ave., Framingham 01701
Lydia Bogar (Grafton)	8 Bernard Rd., N. Grafton 01536
David C. Robbins (Grafton)	92 George Hill Rd., Grafton 01519
Edward J. Ropiak (Grafton)	22 Cross St., S. Grafton 01560
John A. Reil (Grafton)	78 Wesson Rd., N. Grafton 01536
David S. Goldman (Hopkinton)	20 Fruit St., Hopkinton 01748
David A. Holbrook (Hopkinton)	135 Fruit St., Hopkinton 01748
Andrew J. Boyce (Hopkinton)	281 Cedar St., Hopkinton 01748
Margaret Lavallee (Millbury)	14 Oaks St., Millbury 01527
Jeffrey Dore (Millbury)	1484 Grafton Rd., E. Millbury 01527
Fred Moseley (Millbury)	122 Millbury Ave., Millbury 01527
Stephen Bishop (Millbury)	127 Elm St., Millbury 01527
Mary MacAdam (Millbury)	6 Ackerman Rd., E. Millbury 01527
Patricia Murphy Capone (Southboro)	21 Richards Rd., Southborough 01772

Citizens Advisory Committee (continued)

Wayne Thies (Southborough)	42 Latisquama Rd., Southborough 01772
William J. Christensen (Southboro)	17 Granuaile Rd., Southborough 01772
Mark W. Davis (Southborough)	13 Skylar Dr., Southborough 01772
Judith McCabe (Westborough)	15 Maynard St., Westborough 01581
Michael O'Bryan (Westborough)	23 Steven Rd., Westborough 01581
Stephen Doret (Westborough)	23 Mill Rd., Westborough 01581
James (Randy) Waterman (Westboro)	25 Nash St., Westborough 01581
Robert Gentile (APT)	77 Cottage St., Framingham 01701
Kathleen Bartolini (MetroWest)	8 View Hill Rd., Southborough 01772
Ed Bates (MAPC)	MAPC, 60 Temple Pl., Boston 02111
Senator Matthew J. Amorello	State House Rm. 314, Boston 02133

APPENDIX B

FRAMINGHAM TERMINAL PROJECT CORRESPONDENCE AND INFORMATION

1.	Town of Framingham on Station Design	10-25-95
2.	Framingham Terminal Development Notice of Project Change	11-30-95
3.	Framingham Planning Department on Notice of Project Change	12-28-95
4.	MEPA Certificate on Notice of Project Change	1-10-96

Town of Framingham
Massachusetts 01701
Selectmen's Office
Telephone 620-4811
Fax 620-5910

MICHAEL M. ROSSI, Chairman
JOHN A. STEFANINI, Clerk
KATHLEEN M. PENDERGAST

EDGAR C. GADBOIS
Executive Administrator

October 25, 1995

James Eng, Project Manager
Regional Construction Office
MBTA
1515 Hancock Street
Quincy, MA 02169

Re: *South Framingham MBTA Station*
Proposed Design Comments

Dear Mr. Eng:

Thank you for spending time with members of Framingham's Downtown Streetscape Committee and staff and for being open to our suggestions for the station design. I have outlined some of the issues which the Committee has indicated should be considered as the MBTA proceeds with the plans for improvements to the South Framingham Station. These comments are also intended as a basis for meetings that should be held between the Town of Framingham, representatives of MBTA and Conrail and the primary parties involved with this project.

In considering the proposed South Framingham Terminal project plans, the Town is concerned that the design will isolate the train station, cutting it off from the Downtown and the other modes of transportation which serve the Town's central business district. This will at once immensely impoverish downtown life, severely inconvenience commuters, and increase traffic congestion due to commuters seeking parking closer to platform boarding. Moreover, we fear that the proposals for the station will divide and isolate the north and south sectors of the downtown.

The Town insists that every effort is made to *improve* the connection between the station and the downtown with its transportation, commercial and civic resources. Enhancements to the train station can be a real asset to the Town and a benefit to the MBTA. We cannot allow proposed designs to become a detriment to the downtown or to commuters. In view of these concerns we offer the following comments:

PASSENGER PLATFORMS:

- **Close Access:** The proposed plan locates the passenger platforms at least six hundred feet west of their present site. This is unacceptably far from Concord Street, the bus stop and the municipal parking garage. Platforms should be designed so that the train will stand in front of the existing historic passenger station. This will allow the pedestrian overpass across tracks to be aligned more directly to existing and proposed parking facilities north of the tracks as well (see additional comments relating to the pedestrian overpass below).

- **Direct Access**: The platforms currently extend directly to meet Concord Street. In effect they act as sidewalks. Commuters can easily access the Downtown because the platforms offer a visually clear and unimpeded path with immediate access to the public sidewalks which connect to the Downtown and various modes of transportation available there. The proposed plan has west-bound passengers re-routed off this direct travel way in a zigzag path south of the Station's former baggage building (now an insurance office) then out onto Waverly Street. This creates a safety problem because Waverly street is a busy arterial. Further, funneling pedestrians behind the Station and baggage building will place them physically and visually farther from the bus connection and parking lots north of the tracks. We ask that your designers provide continuous and direct pedestrian ways for west-bound and east-bound passengers to Concord Street. The MBTA should request the current owner of the South Framingham station to remove the fence between the building and the west-bound platform to better accommodate passenger flow.

  It is important to note that the MBTA holds an easement from the station owner for the passenger platforms. That easement may be lost if it is not used, which would impact not only current plans, but also future planning options. The Town cannot allow this to occur. Clearly, use of the easement should continue both for greater passenger convenience and to retain future rights.

- **Platform finish**: The pedestrian connection to Concord Street should be of equal finish and use the same pallette of materials, benches, and lights currently under development in connection with the Town's Downtown Streetscape Improvement Project. We are happy to note that the there will be no chain link fence. Instead all fencing will be of wrought iron, painted black, for both inter-track fence and the north "wye" pedestrian control.

PEDESTRIAN OVERPASS:

- **Overpass Alternative**: The proposed pedestrian overpass, intended to span the tracks, will be a massive structure exceeding 33 feet in height and almost 100 feet in width and is expected to cost three quarters of a million dollars to construct. We question whether a pedestrian seeking to cross the tracks will willingly traverse the 850+ feet that would have to be travelled to get from Ramp A on the north side of the tracks to Ramp B on the south side, particularly when this distance is compared to the at grade north/south distance of 30± feet. Furthermore, the overpass will be an imposing intrusion that will have a strong and arguably adverse visual affect on the downtown area. The design certainly is not consistent with the architectural character of the existing station and its surroundings. The Town strongly believes that alternatives to this overpass must be considered. We acknowledge the safety concerns which drive the need to separate pedestrian crossings from track activity but we believe that at-grade crossings with warning devices or sub-grade pedestrian crossings would impose far less of an impact on the downtown while addressing the safety concerns at issue. In any event, the design of the crossing absolutely must assure easy pedestrian accessibility to parking areas north and south of the tracks, as mentioned above and in sections which follow.

- **Overpass location**: The foregoing notwithstanding, the proposed pedestrian overpass is currently located at the far western end of the extended platform. This location makes boarding for the inbound trip inordinately difficult for pedestrians approaching from the Downtown, the bus station, and all of the people parking on the north side of the tracks. These problems may be addressed by locating the pedestrian overpass closer to Concord Street and about equidistant from the platform ends, i.e., moving it in an easterly direction.

- **Handicapped access**: The Town is aware that the MBTA is facing two difficult problems: first, handicapped parking must be placed close to both the pedestrian overpass and the raised access platform and second, in more effectively relocating the overpass. The raised access platform, must be

located at the east-bound end of the platform. The first problem may be resolved by providing two areas for handicapped parking; the second by locating the platforms closer to Concord Street, as suggested above.

COMMUTER PARKING:
The impact of increased service to Worcester on commuter parking has already been keenly felt in downtown Framingham. The limited number of short term parking spaces otherwise available in the vicinity of the station have been consumed for commuter parking placing an unacceptable pressure on Downtown shoppers, merchants and service providers. This condition has created parking overflow along many of the residential streets north and south of the station. Demand for parking spaces in the municipal parking garage (Pearl Street) increased simultaneously with the initiation of extended service reaching a point where virtually all spaces have been leased to commuters. Clearly provision for parking at what is know as the flexi-flow lot is needed but additional parking must also be provided north of the tracks. Ample and convenient parking spaces in both of these quadrants would help to minimize the volume of vehicular crossings at the 135/126 intersection. Commuters from the north and south need to be directed to parking spaces that would be available in those respective areas.

The "kiss-and-ride" area within the station parking lot along Waverly Street should be expanded to permit access for additional vehicles. The area is presently approximately 30 feet wide which would only permit 2 vehicles to drop off simultaneously. We recommend that this area be redesigned to permit access for up to 4 automobiles.

PEDESTRIAN ACCESS TO THE STATION FROM ELSEWHERE:
We strongly encourage the MBTA to obtain two easements from Conrail. The first would be a landscaped path across the North "wye", for access to existing parking in the Pearl Street municipal garage. This pedestrian pathway should be aligned with the pedestrian overpass. The second walkway should connect with the Franklin Street extension to provide pedestrian access to the MBTA parking lot.

LANDSCAPING:
A 10 foot wide landscaped area should be created along the front of the proposed MBTA south "wye" lot on Waverly Street. The new lot should be connected to the station by way of a clearly identifiable, paved crosswalk on Waverly Street with a sidewalk on the southerly side of Waverly which provides conspicuous pedestrian connections to the Hollis Court parking lot. The MBTA should agree to provide the Town with detailed specifications and drawings for landscaping so they can be coordinate with our ongoing streetscape improvement project.

The MBTA has stated that it will be happy to provide landscaping for the station and commuter parking lots provided that the Town provides a maintenance plan. Landscaping should also be planned for the North "wye" and on Waverly Street. It will provide a maintenance plan for any landscaping installed by the MBTA at its earliest opportunity.

TICKET SALES LOCATION:
Tickets are currently sold only in Garbarino's Package Store on the south side of Waverly Street, and there are no signs which indicate that tickets can be purchased at this store. Under proposed plans, this location will be more of an inconvenience to passengers coming from north of the tracks than it is now. The insurance office in the historic baggage building would be an excellent location for ticket sales. Commuters would then not need to cross the congested Waverly St. and west-bound and east-bound passengers would have equal access. Reuse of this small structure would also reclaim this historic building and provide a better environment for the station.

MITIGATION:
The Town is aware that the city of Fitchburg has just received extensive mitigation funds from the MBTA. The Authority turns over all moneys received from its parking operations there to the Town. The Authority also provides annual Streetscape and landscape improvements to areas impacted by the station. The issue of project mitigation was raised in the EIR prepared in conjunction with the Worcester Commuter Rail Extension project (Section 18) and, in response to MBTA's acknowledgment that mitigation is appropriate and in view of precedent for mitigation commitments made elsewhere, the Town asks that consideration be given to the following:

- One of the most significant hurdles to revitalizing the downtown area is developing an effective solution to the congestion that is created at the intersection of the railroad tracks, Routes 126 and Route 135. Activity at the tracks is the primary source of the traffic congestion which regularly occurs at this intersection due to the 45 to 50 gate closing that occur each day when trains cross these roadways. The Worcester extension will increase the number of gate closing by 20%, according to the EIR prepared for the project. This will significantly add to the number of times per day that traffic along the primary north/south corridor through Framingham will be brought to a standstill. This condition will further degrade the level of service of an intersection that already continuously operates at a LOS "F", or complete and utter failure. This problem has been a focus of strong concern and the subject of numerous studies for the past 100 years. The Town is presently considering short- and long-term solutions to this problem and we believe that sufficient consensus has been generated to proceed with measures to address it.

  In the short term, and in light of your contribution to the problem, we ask for MBTA's commitment to play a part in underwriting the costs to upgrade the existing intersection traffic signals and improve the layout of this intersection. The traffic congestion that regularly occurs at this intersection, due almost entirely to the gate closures that accompany each train trip, is wholly unacceptable and immediate measures to mitigate this condition are absolutely necessary.

  In the long-term we ask that MBTA continue to play an active role in the 126 Corridor Study and and that the Authority stand ready to make financial contributions to the solutions we expect will stem from this effort. We believe that the connection between the 126 Corridor Study and the Central Artery project must not be overlooked. Commuter trips, which constitute the bulk of the number of increased rail crossings through the downtown, will significantly help to relieve trip generation on the Mass Pike throughout the life of Central Artery construction activity. Perceived from this perspective, the Framingham 126/135 Corridor *Solution* could be seen as a related and necessary mitigation cost for Massachusetts' largest roadway improvement project.

- We request MBTA's active participation in the Downtown Streetscape Improvement Plan. The plan proposes a series of improvements at the Framingham station which will provide strong and positive assistance in meeting the important objective of creating and reinforcing links between the modes of transportation available in the downtown area.

- The EIR prepared in conjunction with the Worcester Commuter Rail Extension indicated that the MBTA would "*...perform travel time studies of Route 126 prior to and after commencement of Interim Service...*" (p.18-3 of DEIR, November 1984). We request the opportunity to review these studies and the conclusions that may be drawn from their results.

MULTI-MODAL FOCUS:
Many of the foregoing comments stress the need to ensure that the station is *connected* to other modes of transportation available in downtown Framingham. Through careful design the Station could serve as a

model for multi-modal transportation planning providing safe, direct and immediate access to local bus stops, parking areas and pedestrian ways thereby knitting the station into the fabric of the downtown environment. This objective could be furthered by giving greater attention to bicycle access to the station. Bicycle storage racks should be located on both the north and south side of the tracks. The project should also provide for easily accessible, protected bicycle storage lockers (on both the east-bound and west-bound platforms) to encourage bike-to-train connections.

REUSE OF HISTORIC TRANSPORTATION STRUCTURES:
Under proposed plans, the H. H. Richardson train station will be isolated and placed further from passengers. The Town strongly feels that it cannot accept cookie cutter solutions. We encourage the MBTA to purchase this historic building to restore and reuse it, treating this building as an asset, not a barrier.

We anticipate full and open dialogue relative to the issues and concerns raised above and look forward to working with you.

Sincerely

Michael Rossi

Michael Rossi, Chairperson
FRAMINGHAM BOARD OF SELECTMEN

cc: Patrick Moynahan, Executive Director
Congressman Edward Markey
Senator David Magnani
Representative Barbara Gray
John Stasik, MBTA CAC Framingham Designate
John McMahon, Public Works Director
MBTA Town Municipal Coordinator
David M. Kutner, Planning Director
MBTA Town Municipal Coordinator
Joseph Champagne, Town Engineer
Lewis Colten, Building Commissioner
Michael Donnelly, Traffic Safety Officer
Kathy Bartolini, Metrowest Growth Management Committee

Massachusetts Bay Transportation Authority

William F. Weld
Governor

Argeo Paul Cellucci
Lieutenant Governor

James J. Kerasiotes
Secretary and MBTA Chairman

Patrick J. Moynihan
General Manager

November 30, 1995

The Honorable Trudy Coxe, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th Floor
Boston, MA 02202

RECEIVED
By_____

ATTN: MEPA Unit

RE: Framingham Terminal Development - EOEA #10106
Notice of Project Change

Dear Secretary Coxe:

The Massachusetts Bay Transportation Authority (MBTA) is submitting this Notice of Project Change relative to the proposed Framingham Terminal Development Project (EOEA #10106) currently under review by your Massachusetts Environmental Policy Act (MEPA) Unit. We ask by this letter that you reconsider the requirement for an Environmental Impact Report (EIR) on this project concerning the historic canopy structure. We have redesigned the project so that the canopy can be relocated, restored and preserved. We also ask that you allow us to deal with traffic and parking questions at Framingham as part of our ongoing MEPA review of the Worcester Commuter Rail Extension Project (EOEA #9154). Most of the analyses necessary for these considerations are being done as part of that study.

The project was first noticed in the Environmental Monitor on August 23, 1994, following our submission of an Environmental Notification Form. In your Certificate of September 22, 1994, you determined that an EIR would be required: the proposed demolition of the canopy structure, listed on the Historic Register, caused the project to be Categorically Included for the preparation of an EIR. You further stated that should the project be revised such that the canopy structure would not be demolished, a Notice of Project Change could be submitted and the requirement for an EIR would be re-examined and you indicated that a Notice of Project Change should be filed when the need for and design of additional parking had been resolved.

Preservation of the Historic Canopy

Following the receipt of your Certificate, staff of the MBTA met with staff of the Massachusetts Historical Commission (MHC) regarding the historic canopy. Also included in this meeting and site walk were representatives from the Framingham Historical Commission and the Framingham Planning Department. The MHC indicated that it

would be receptive to relocating the structure in the vicinity of the station. The removal and relocation of the canopy would be accomplished in close coordination with the MHC.

In April 1995, the historic canopy was inspected to determine its condition and feasibility for relocation. While the canopy is in fair to satisfactory condition overall, there are deficiencies to the columns, beams and roof alignment which require repair. The MBTA proposes to repair and relocate the historic canopy close to and slightly northwest of its existing location. Enclosed are plans and a procedure for the proposed relocation. Prior to the start of work, we will provide the MHC and the Framingham Historical Commission with detailed descriptions of the existing condition of the historic canopy and its renovation and relocation.

Intertrack Fence

In your Certificate you also requested information regarding other design elements and pedestrian amenities at the station. The decision regarding the type of intertrack fencing to be provided has not been finalized. The fencing will not be more than four (4) feet high. Options currently include removable chain link fencing or removable wrought iron fencing, contingent upon discussions with the town of Framingham and Conrail. Conrail's operations dictate that the intertrack fencing have the ability to be easily removed and replaced to allow track maintenance, specifically tie replacement.

Pedestrian Amenities

The MBTA proposes to locate benches for passengers on the train platforms. The MBTA will coordinate the design of the lighting fixtures with the town. It is our policy to install vandal-resistant, unobtrusive lighting fixtures. To the greatest extent feasible, these design elements and pedestrian amenities will be compatible with the State Register property.

Attached for your information is a copy of a December 27, 1994 letter from the State Historic Preservation Officer (SHPO), in which she indicated that she concurs to a finding of no adverse effect for these actions, provided that the MBTA coordinate the plans and specifications for the canopy and intertrack fencing with the MHC and the Framingham Historical Commission.

Given our proposal to renovate and relocate the historic canopy, our commitment to work closely with the Massachusetts Historical Commission and the Framingham Historical Commission through final design and construction, and the SHPO concurrence with our activities, the MBTA is requesting that you withdraw your requirement for an Environmental Impact Report concerning the historic canopy structure.

When the ENF was filed, it was expected that Phase I of the Framingham Terminal Project would include ten (10) additional parking spaces and that Phase II might include

as many as 350 additional spaces, with Phase II to proceed after the completion of the Worcester Commuter Rail Extension Project. Since then, The Phase I proposal has been increased to approximately 100 parking spaces, making use of lands available in the ConRail Wye south of Route 135 and west of the Framingham Station. Phase II still is proposed in the long term to provide 350 spaces. As it has developed, the Worcester Project and any additional parking at Framingham should be linked together, as suggested in your recent Certificate and many of the comments on the Track and Layover Final EIR for the Worcester Commuter Rail Extension Project.

We propose to address Framingham traffic questions in the next Final EIR on the Worcester Project, for the Millbury and Grafton Stations, and to discuss in that document both Phase I and Phase II additional parking at Framingham. We note in passing that more systemic problems with traffic in Framingham downtown and long term solutions are being examined by others as part of the Route 126 Corridor Study, the progress of which we will report. We propose to examine shorter range solutions than what might be implemented at the intersections closest to the Framingham Station to set off the effects of any additional traffic attracted to the station by the Worcester Commuter Rail Extension Project. We then can address any questions or comments raised on the Framingham Terminal Project in the third Final EIR for the Worcester Project, for the Westborough, Southborough and Ashland Stations. It is our belief that this consolidated process provides the better method with which to afford both public and agency review of the Framingham Terminal proposals and of the Worcester Commuter Rail Extension Project.

We look forward to your action on this request. Please contact Mr. Andrew Brennan, MBTA Manager of Environmental Affairs, at 222-3126 if you require additional information.

Sincerely,

Patrick J. Moynihan
General Manager

Enclosures

FRAMINGHAM MBTA STATION
OUTBOUND CANOPY

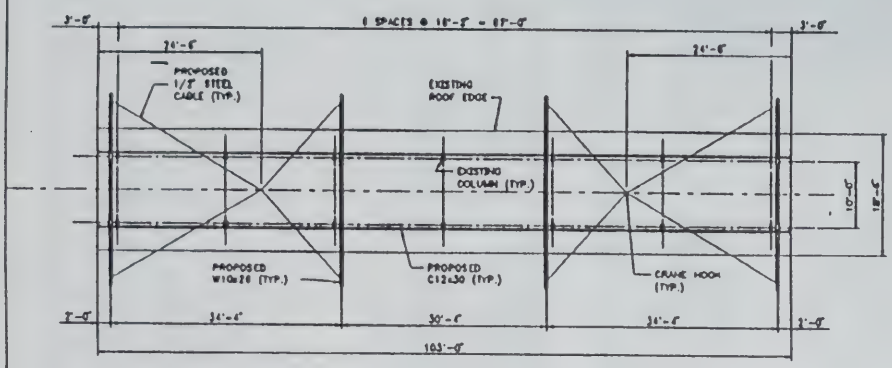
PROCEDURE FOR RELOCATION

STEP 1 Erect the steel lifting frame on the existing canopy.

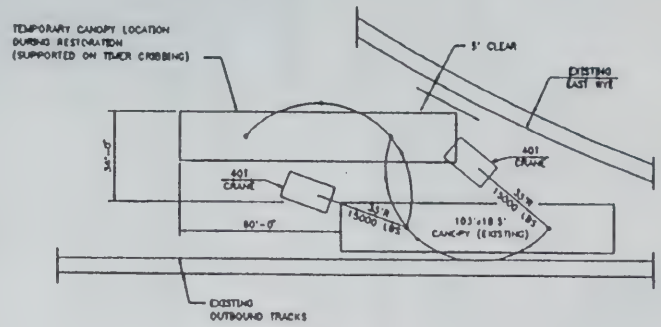
STEP 2 Cut the existing columns at the joint located at the base of the curved support arms and the center post. Using two 40 ton cranes (or equivalent cranes), lift and swing the top part of the canopy onto temporary supports (timber cribbing) located in the area between the existing outbound MBTA tracks and the east wye.

STEP 3 Conduct repairs and renovation of the existing canopy while it is located on the temporary supports. At the proposed canopy location, construct the new canopy footings and and erec the new timber columns.

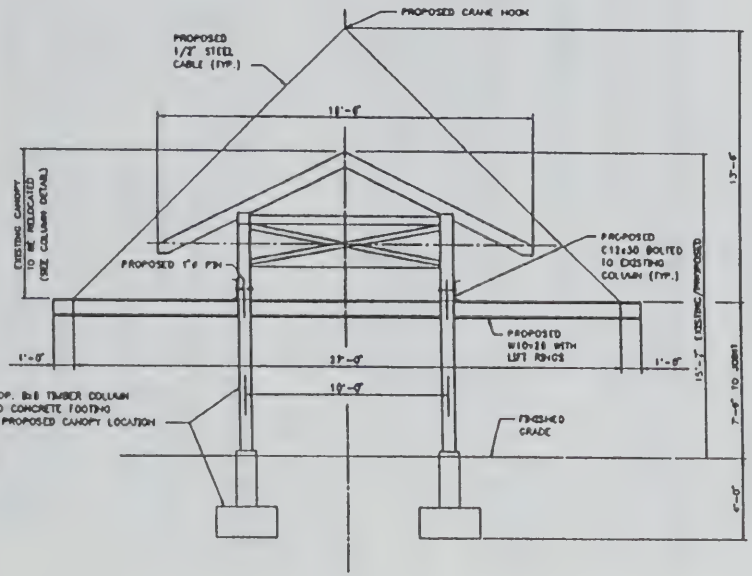
STEP 4 Using two 40 ton cranes (or equivalent cranes), lift the repaired canopy from its temporary supports to the proposed canopy location, and set the canopy onto the new footings and columns.



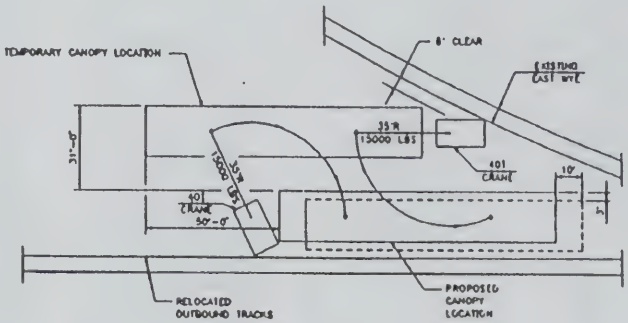
PLAN - LIFTING FRAME
1" = 10'



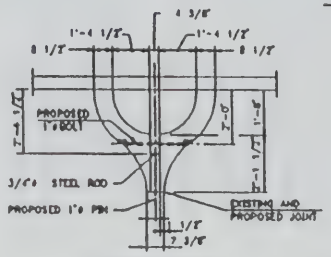
RELOCATION PLAN - A
1" = 10'



TYPICAL SECTION
CANOPY WITH LIFTING FRAME
1/8" = 1'-0"



RELOCATION PLAN - B
1" = 10'



COLUMN DETAIL
1/8" = 1'-0"

PROGRESS SUBMITTAL

OUTBOUND PLATFORM CANOPY
RELOCATION CONCEPT

W:\81633P\CY\DWGT\C1-04 08/10/95 14:10

December 27, 1994

Rodney E. MacCormack
MBTA
Ten Park Plaza
Boston, MA 02116-3974

RE: MBTA Framingham Railroad Terminal Development (Phase 1), Framingham, MA; EOEA No. 10106

Dear Mr. MacCormack:

Thank you for the additional information you submitted, received November 30, 1994, regarding the proposed relocation of the passenger shelter on the north side of the Framingham Railroad Station. The station and passenger shelter are listed in the State and National Registers of Historic Places. This information was previously discussed in a site visit and meeting on September 22, 1994 between representatives of the MHC, MBTA, the Framingham Historical Commission, and the Framingham Planning Department.

MHC staff understand that, in order to increase the track center lines from 12 to 14 feet and to provide for intertrack fencing, the free-standing passenger shelter is proposed to be moved approximately 10 feet to the west and 2 feet to the north of its existing location. As was discussed at the meeting, the shelter would be moved in accordance with standard preservation practices and would be rehabilitated and restored at its new location.

After review of the materials submitted, I concur to a finding of no adverse effect for this action (950 CMR 71.07 (2)(b)(2)) provided the following conditions are met: the MHC and the Framingham Historical Commission have the opportunity to review and approve plans and specifications for the relocation and restoration of the shelter and the design and materials of the proposed intertrack fencing.

These comments are provided to assist in compliance with Massachusetts General Laws, Chapter 9, Sec. 26-27c, as amended by Chapter 254 of the Acts of 1988 (950 CMR 71.00) and MEPA.

If you have additional questions, please contact Allen Johnson of this office.

Sincerely,

Judith B. McDonough

Judith B. McDonough
Executive Director
State Historic Preservation Officer
Massachusetts Historical Commission

cc: Framingham Historical Commission
Heli Meltzner, Framingham Planning Department
Andrew Brennan, MBTA

Massachusetts Historical Commission, Judith B. McDonough, *Executive Director, State Historic Preservation Officer*
80 Boylston Street, Boston, Massachusetts 02116-4802 (617) 727-8470 Fax: (617) 727-5128 TDD: 1-800-392-6090

FRAMINGHAM PLANNING DEPARTMENT

150 CONCORD STREET • MEMORIAL BUILDING • ROOM B-2 • FRAMINGHAM, MA 01701-8373 TELEPHONE: 508.620.4852
FAX: 508.620.4818

28 December 1995

Secretary Trudy Coxe
Massachusetts Executive Office of Environmental Affairs
100 Cambridge Street, Floor 20
Boston, MA 02202

RECEIVED
DEC 29 1995
MEPA

Attn.: Janet Hutchins

Re: EOEA No. 10106
Framingham Terminal Development
Notice of Project Change

Dear Secretary Coxe:

The Planning Department has reviewed the MBTA's Notice of Project Change for the Framingham Terminal Development which seeks your approval not to submit an Environmental Impact Report (EIR). The Planning Department offers the following comments in response to this Notice:

Parking and Traffic:
The Planning Department has concerns about increases in traffic and parking demand, and about specific proposed station improvements.

Your Certificate of Sept. 22, 1994 refers to **Phase II** of the project and states:

> *"The MBTA proposes to review parking demand at Framingham following the full activation of the Worcester Commuter Rail Extension, which will include new stations to the west of the current Framingham Terminal. It is anticipated that these new stations will absorb some of the demand at Framingham. The MBTA has agreed to file a Notice of Project Change when plans for* ***Phase II*** *are being developed."*
>
> *"...The Town of Framingham note(s) that the addition of express trains from Framingham to Boston associated with the upcoming Worcester Extension will likely increase readership boarding at Framingham. I agree that this new express service will make the Framingham Terminal more attractive to commuters and may increase the traffic impact and parking demand in the immediate Terminal area. Because the ENF focused on the traffic impact related to the* ***Phase I*** *addition of ten parking spaces, rather than on the impact of the additional service*

> *I expect the MBTA to provide a thoughtful traffic analysis that addresses the broader based traffic issues raised in the comments in conjunction with the Notice of Project Change to the filed for* ***Phase II****. Additionally, I encourage the MBTA to continue to work directly with the community on the immediate traffic, parking and pedestrian access concerns expressed in the comments on the ENF.*"

The Town of Framingham faces a difficult dilemma. This Terminal Improvement Project was originally segregated from the Worcester Commuter Rail Extension Project under the assumption that stations west of Framingham would be operational in the near future. However, that schedule has been delayed. As a consequence the assessment of parking demand in Framingham, which was to be evaluated in connection with Phase II of the project, will be delayed as well. In the interim the new MBTA express service, which has experienced high ridership volumes, has resulted in demands for parking in the Terminal area which far exceed supply. Parking overflow throughout the areas adjacent to Terminal parking lots has markedly reduced parking availability for Downtown merchants, service providers and residents. Significantly, this condition has also contributed to a great deal of commuter frustration due to the lack of sufficient parking.

The MBTA stated that it would be conducting parking studies to determine additional parking requirements. The Town of Framingham has seen no parking data either on base-line studies or increased demand. As a first step, the Town asks that the MBTA provide precise parking demand counts so that future needs may be more accurately determined. In addition, the MBTA must provide additional parking in the Terminal area to relieve current parking pressure.

Another as yet unresolved traffic issue is associated with the amount of mitigation funds for increased traffic impacts. This issue should be resolved before the MEPA review relative to this project is closed.

Moreover, there are unresolved pedestrian safety and traffic management issues relating to ticket purchase at a liquor store across Waverly Street. The Town believes that a more efficient resolution to this problem must be proposed by the MBTA as part of this project.

The Town raised these issues in a length comments letter that was submitted to the MBTA in response to the 75% plans submitted for our review. These comments (see letter attached) remain unanswered but, we believe, constitute significant design issues that must be resolved before the Station improvements can be undertaken.

Proposed Station Design

The Town adamantly requests that this project continue to be reviewed by the Massachusetts Historical Commission, because it directly and significantly impacts a property listed on the National Register of Historic Places. While the MBTA proposes to provide the Town and MHC with "*detailed descriptions of the existing condition of the historic canopy and its renovation and relocation*", we request the opportunity to review specific design plans and specifications and ask that this information be submitted in a timely fashion to afford meaningful review.

In addition, the MBTA is still considering a chain link fence for the inter-track fencing. However, at a meeting with MHC and the Town, the MBTA agreed that new materials would match the existing fencing. The MBTA should fulfill its promise to MHC and the Town.

Furthermore, the Town and MHC have never been afforded the opportunity to review station finish and amenities such as benches, landscaping, bike racks and bike storage lockers for their impact on the historic station. Town staff has been working with representatives from the MBTA regarding pedestrian access. The MBTA should be encouraged to continue to work with both Town and MHC to successfully resolve these all outstanding questions relative to station design.

Thank you for providing us with the opportunity to comment on the ENF for the proposed South Framingham Terminal Improvement Project in Framingham. Please include the Framingham Planning Department on the list of interested parties to whom additional information is sent.

Sincerely,

David M. Kutner, AICP
PLANNING DIRECTOR

cc: Patrick Moynahan, Executive Director
Congressman Edward Markey
Senator David Magnani
Representative Barbara Gray
John Stasik, MBTA CAC Framingham Designate
John McMahon, Public Works Director
MBTA Town Municipal Coordinator
David M. Kutner, Planning Director
MBTA Town Municipal Coordinator
Joseph Champagne, Town Engineer
Lewis Colten, Building Commissioner
Michael Donnelly, Traffic Safety Officer
Kathy Bartolini, Metrowest Growth Management Committee

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, 02202

WILLIAM F. WELD
GOVERNOR
ARGEO PAUL CELLUCCI
LIEUTENANT GOVERNOR
TRUDY COXE
SECRETARY

Tel: (617) 727-9800
Fax: (617) 727-2754

January 10, 1996

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE NOTICE OF PROJECT CHANGE

PROJECT NAME	:	Framingham Terminal Development
PROJECT LOCATION	:	Framingham
EOEA NUMBER	:	10106
PROJECT PROPONENT	:	Massachusetts Bay Transportation Authority (MBTA)
DATE NOTICED IN MONITOR	:	December 8, 1995

Pursuant to the Massachusetts Environmental Policy Act (M.G.L. c. 30, ss. 61-62H) and Section 11.17 of the MEPA regulations (301 CMR 11.00), I have reviewed the Notice of Project Change submitted on the above project, and hereby determine that the preparation of an Environmental Impact Report (EIR) is not required for Phase I of the project, excluding the provision of additional parking. The remaining issues associated with the development of the Framingham Terminal, including traffic, the provision of additional parking and pedestrian safety, must be addressed in the Worcester Commuter Rail Expansion project (EOEA #9154) Final EIR on the Millbury and Grafton Stations and Railroad Operations.

As originally proposed, this project had two phases. Phase I included the construction of a pedestrian overpass with handicapped access; extension of the passenger platforms; relocation of track; intertrack fencing; reconstruction of the parking area; and the addition of ten parking spaces and construction of a commuter drop off/pick up area.[1] Phase II consisted of the construction of an additional 350 parking spaces. The project was categorically included for preparation of an EIR because a platform passenger shelter that was listed on the State and National Registers of Historic Places was proposed to be demolished. Because Phase II was not scheduled for implementation until several years in the future, it was not

[1] The Phase I improvements were designed primarily to comply with the Americans with Disabilities Act (ADA).

included in the EIR scope; the MBTA agreed to submit a Notice of project Change for Phase II when plans for it were developed.

Phase I

Following a meeting between the MBTA, the Massachusetts and Framingham Historical Commissions (MHC/FHC) and the Framingham Planning Department, the MBTA agreed to restore the shelter and relocate it on the platform. MHC has determined that the modified proposal will have "no adverse effect" on the State Register property, with the condition that the MBTA continue to consult with MHC and FHC in the review and approval of plans and specifications for the shelter and the design and materials of the proposed intertrack fencing. Given those conditions, I find that an EIR will not be necessary for Phase I of the project, with the exception of the provision of additional parking. MHC also requests that it be afforded the opportunity to review the design and location of passenger benches, lighting fixtures, new platforms and pedestrian crossovers. I recommend that the MBTA also consult with MHC on these matters.

Phase I Parking and Phase II

In the Notice of Project Change, the MBTA requested permission to transfer the analysis of the remaining issues associated with the Framingham Terminal Development to the Worcester Commuter Rail Extension project (EOEA #9154) Final EIR on the Millbury and Grafton Stations and Railroad Operations.[2] As it is uncertain when the siting of the three stations to the west of Framingham will be decided, I agree that the analysis of the Framingham Terminal is most appropriately done within the scope of the Worcester Extension project. Therefore, I hereby grant the MBTA's request. All comments that were received on the Framingham Terminal ENF and NPC, other than those that relate to

[2] A Certificate on a Notice of Project Change on the Worcester Commuter Rail Extension is being issued concurrently with this Certificate. That Certificate authorizes the MBTA to divide the Final EIR on Stations and Railroad Operations into two separate documents: a FEIR on the Millbury and Grafton Stations and Railroad Operations, and another FEIR on the Westborough, Southborough and Ashland Stations.

the Phase I ADA improvements and the historic shelter, should be addressed in the Railroad Operations/Grafton and Millbury Stations FEIR.

January 10, 1995
DATE

Trudy Coxe

Comments received : MHC, 12/28/95
Framingham Planning Dept., 12/28/95
MetroWest Growth Management Committee, undated

TC/JH/jh

APPENDIX C

MILLBURY STATION, GRAFTON STATION, RAILROAD OPERATIONS SECTION 61 FINDING (DRAFT)

(DRAFT) SECTION 61 FINDING
BY THE
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
CONCERNING THE
WORCESTER COMMUTER RAIL EXTENSION PROJECT
MILLBURY AND GRAFTON STATIONS, RAILROAD OPERATIONS, AND SELECTED ACTIVITIES AT THE FRAMINGHAM STATION
EOEA #9154

As required by Massachusetts General Laws, Chapter 30, Section 61, the Massachusetts Bay Transportation Authority (MBTA) has reviewed the environmental effects of the proposed stations in Millbury and Grafton, of outstanding issues related to the railroad operations, and of certain improvements planned in Framingham. Following upon that review, the MBTA finds below that all feasible measures first to avoid and then to minimize those effects.

MBTA Mitigation Policy

The MBTA's Mitigation Policy is described in detail in Section 3.7 of the FEIR. For traffic impacts, the general rule is "if the MBTA breaks it, we will fix it." Noise and vibration impacts were evaluated in terms of Federal Transit Authority (FTA) criteria, supplemented by the Massachusetts Department of Environmental Protection (DEP) noise policy. In addition, noise and vibration mitigation impacts were subject to recently adopted MBTA policy which limits the expenditure for noise and vibration mitigation to 2% of the project construction cost. In this manner consideration of the cost effectiveness of noise and vibration mitigation has been weighed against the actual relief provided. Impacts to wetland, archaeological and historic resources along the right-of-way and in the station designs has been to avoid impact where possible; to minimize impacts where avoidance is not possible, mitigating impacts in accordance with appropriate regulatory requirements.

MEPA Chronology

An Environmental Notification Form (ENF) for the entire Worcester Commuter Rail Extension Project was filed with the Secretary of Environmental Affairs on August 17, 1992 and notice of the filing was made in the *Environmental Monitor* on August 24, 1992. With the concurrence of the MBTA, the Secretary issued a Certificate on October 8, 1992 establishing a Special Procedure for a Major and Complicated Project and establishing a Citizens Advisory Committee to assist her in the review of the project. On October 22, 1992, the Secretary issued a Certificate on the ENF establishing the scope for the required Environmental Impact Report (EIR).

A Draft EIR on all the elements of the proposed project was filed with the Secretary on November 30, 1994 and notice of the filing was made in the *Environmental Monitor* on December 7, 1994. The Secretary issued a Certificate on March 16, 1995 finding the Draft EIR adequate.

A Notice of Project Change (NPC) was filed with the Secretary on May 12, 1995 requesting that the MBTA be allowed to proceed under the Special Procedure to prepare one Final EIR for the track and layover work and a subsequent Final EIR for station location and operation matters. Notice of this request was made in the *Environmental Monitor* on May 23, 1995, and the Secretary concurred with the MBTA request in a Certificate issued on June 22, 1995.

A Final EIR for the Railroad Right-of-Way and Layover Facility was filed on July 31, 1995 and notice of the filing was made in the *Environmental Monitor* on August 8, 1995. On September 14, 1995, the Secretary issued a Certificate finding this FEIR adequate. The MBTA issued Section 61 Findings for elements covered in this FEIR.

Due to unresolved issues pertaining to the proposed Westborough, Southborough, and Ashland Stations, another NPC was filed with MEPA on October 31, 1995 and Noticed in the *Environmental Monitor* on November 7, 1995. This NPC requested permission to address outstanding issues in two separate FEIRs: one to address the Millbury and Grafton Stations and operations; and another to address station and operation issues in Westborough, Southborough and Ashland. On January 10, 1996, the Secretary issued a Certificate which permitted the MBTA to file two FEIRs for the stations and operations as had been requested.

Also on January 10, 1996, the Secretary issued a Certificate on Notice of Project Change filed by the MBTA for EOEA #10106, the Framingham Terminal Development. This Certificate permitted the MBTA to undertake several improvements at the Framingham Station primarily to comply with Americans with Disabilities Act (ADA) and, in consultation with the Massachusetts and Framingham Historical Commissions, to restore and relocate the passenger shelter. In addition, the Secretary agreed that the MBTA should address "Phase I" parking issues in Framingham as part of the Worcester Commuter Rail Project's second FEIR.

Railroad Operations/Impacts of Service

Regional Air Quality
The environmental analysis has demonstrated that the introduction of Basic Service to Worcester will result in reductions in emissions of Volatile Organic Compounds (VOC), in Oxides of Nitrogen (NO_x), and in Carbon Monoxide.

Noise
The project will result in noise impacts to seven residential properties along the corridor, five of which are located adjacent to each other on Westborough Street in Grafton. The MBTA, subject to abutter preference, will construct a 500 foot long noise barrier in this location to reduce noise impact from Basic Service train operations.

Vibration
Basic Service to all stations will result in vibration impact to 15 residences. Service to Millbury and Grafton only will temporarily increase the number affected residential units to 23. As described in the FEIR for the layover facility and Railroad Right-of-Way, the most effective mitigation for these impacts is proper maintenance of rolling stock.

Archaeological and Historical
Due to the unusually cold winter, the archaeological and historic evaluation of the project is not yet complete. The MBTA and Massachusetts Historical Commission (MHC) have agreed to abide by Memorandum of Agreement (MOA) to complete the outstanding work and to guide the process of avoidance, minimization and mitigation of impacts on archaeological and historic resources. A draft MOA was included in Appendix H of this FEIR.

Millbury Station

Traffic
The traffic analyses of roads and intersections within the Millbury study area were reviewed to identify locations which may require mitigation in accordance with the MBTA Mitigation Policy. The MBTA will install a new traffic signal system at the proposed station access drive intersection at Route 20. The new station driveway and the existing driveway at the Big Y shopping center will be designed to operate as a single, four legged intersection. The proposed signal will permit protected left turns from the driveways and the signal will be interconnected with the existing signal at Route 20 and Sunderland Road to provide for signal timing coordination.

Wetlands/Drainage
Elements of the Millbury Station have been sited to avoid direct impact to wetland resources. A Best Management Plan has been developed for the station and a storm water detention basin will be constructed to ensure no increase in peak rate of runoff after construction. These project elements will be reviewed by the Millbury and Worcester Conservation Commissions and construction will be in compliance with any Order of Conditions issued.

Archaeology
Archaeological investigation of the Millbury Station site and efforts to avoid, minimize and mitigate impacts to archaeological resources will be completed in accordance with the MOA to be signed by the MBTA and MHC (see Appendix H).

Grafton Station

Traffic
The results of the traffic analyses of the streets and intersections in the Grafton study area were reviewed to identify locations which may require mitigation in accordance with the MBTA Mitigation Policy.

Station generated traffic will not cause any study area street or intersection to deteriorate from an acceptable level of service to an unacceptable level of service. Side street traffic at two intersections, North Main Street/Bridge Street and North Main Street/Worcester Street, has unacceptable levels of service (LOS F) in the "No Build" condition. Station traffic will marginally increase delays at these intersections in the "Build" condition. No mitigation is proposed due to the minimal effect of station traffic at this location.

Wetlands
Station construction in Grafton will require filling of approximately 850 square feet of wetland resources in order to construct the driveway and will include additional alteration of buffer zone. Wetland replication is proposed at greater than 1:1 (i.e., 1,300 square feet).

A detention pond is planned to maintain storm water discharge flows below existing conditions (see Table 7.5-1 in the FEIR). The project will implement Best Management Practices (BMPs) to mitigate any storm water impacts including (1) a parking lot sweeping program; (2) catch basins equipped with sumps and oil and grease traps; (3) regular cleaning of catch basins; (4) regular removal of trash and organic debris (leaves, branches, etc.) to both reduce nutrient loadings and keep the storm drain system functional; and (5) consideration of using alternatives to sodium chloride for de-icing.

Archaeology/Historic
An archaeological investigation of the Grafton Station site has shown that no archaeological resources of significance will be impacted by the station construction. Because the site is located within an historic district listed on the National Register of Historic Places, the MBTA will consult with the MHC regarding the station site plans in accordance with the MOA between these agencies.

Framingham Station

Traffic
The MBTA will mitigate impacts generated by the additional gate closings in Framingham by providing immediate improvements at the two adjacent intersections: Waverly Street/Concord Street and Howard Street/Concord Street. The proposed mitigation will improve the traffic flow through these intersections, and capacity analysis indicates that a reduction in delays will result. In addition to physical improvements at these intersections, which were described in detail in Section 8.4 of the FEIR, new parking spaces which will be provided south of Waverly Street will attract riders arriving from the south and west to park south of the track crossing and therefore reducing the number of vehicles crossing the tracks. Vehicles traveling through both intersections will also be reduced, further improving the level of operation on the roadway network near the station.

Construction Impacts

Construction at the station sites will result in short term impacts which are not expected to be significant. Certain phases of construction will experience concentrated deliveries of materials. Similarly, short term, intermittent emissions from construction related equipment and site related construction traffic will result, although no violations of air quality standards are anticipated. Typical measures to minimize fugitive dust will include spraying exposed earth surfaces with water.

Measures to be taken that will minimize impacts of site runoff during construction include limiting the area of earth exposed at any one time and the use of hay bales and silt fences to trap sediments.

Noise and vibration impacts associated with construction activities will also be short term. Impacts can be minimized by limiting working hours to exclude nighttime hours.

APPENDIX D

CTPS RIDERSHIP ESTIMATES

CTPS

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Ten Park Plaza, Suite 2150
Boston, MA 02116-3968
(617) 973-7100
Fax: (617) 973-8855
TDD: (617) 973-7089

CENTRAL
TRANSPORTATION
PLANNING
STAFF

MEMORANDUM

TO: **James Eng, MBTA**

October 16, 1995 (original)
Februray 7, 1996 (revised)

FROM: **Vijay Mahal and Scott Peterson**

RE: **Results of Additional Ridership Analysis for the Worcester Commuter Rail Extension Study**

BACKGROUND:

In May, 1995, the MBTA requested CTPS to perform some additional ridership analysis for the Worcester Commuter Rail Extension Study. The purpose of this request was to answer some key questions which emerged from the DEIR public review process. This memorandum summarizes the results of our analysis. The modeling method used here is identical to the one used in the DEIR process. For your convenience and ready reference, a description of the modeling methodology is attached to the Appendix of this report.

In this round of analysis, we examined two major scenarios, one with a Regional Station (instead of Westboro Station) and another without a Regional Station. Within each scenario, we further analyzed several sub-alternatives to study the impact of not building certain local stations. Using the model, we prepared the ridership and parking demand estimates for each scenario and sub-alternatives for the years 1996, 2001, 2006 and 2011. The enclosed Appendix contains several spread sheets summarizing the ridership results.

The following are some key findings from our ridership analysis. For the purposes of discussion, we are referring to year 2011 ridership estimates only.

KEY FINDINGS: (based on 2011 ridership estimates)

Regional Station Scenario

Alternative 1: All stations included

- Under this alternative, our analysis indicates that building a Regional Station (instead of a local station in Westboro) would increase the overall ridership on the extension (from Framingham to Worcester) modestly. This increase would be in the order of 180 more inbound riders when compared to the case without a Regional Station (see Table 1 and 3). As shown in Table 1, the Regional Station would attract nearly 800

inbound passengers on a typical weekday. This ridership when translated into parking demand, equals roughly 670 spaces (shown in Table 2) which is well within the proposed supply of 1000 spaces.

- The Grafton Station would experience a slight increase in ridership due to the elimination of the Westboro Station.

- The Framingham Station would experience a significant reduction in ridership from the current level. According to some recent data collected in 1995, 1,300 to 1,400 daily boardings took place at Framingham Station. In 2011 with all stations in place (except for Westboro station), we are projecting about 880 daily boardings at Framingham station. This is mainly because a significant portion of the future ridership in the study area would get redistributed among the intermediate stations between Framingham and Worcester. The projected demand at Framingham when translated into parking demand would be about 480 spaces.

Alternative 2: All stations included except Ashland

- When Ashland Station is removed from the analysis, the Framingham Station and the Regional Station gain significant ridership, about 1,230 and 960 daily inbound boardings respectively. This ridership when translated into parking demand equals roughly 800 spaces at each station. Given that the proposed parking supply at Ashland station is 700 spaces, it is likely that over time, the parking demand at the Regional Station will increase to accomodate the unmet latent demand at Ashland. When compared with the Alternative 1 (the "All Station" scenario), the overall ridership from Worcester to Framingham would decrease by 400 riders as a result of not building the Ashland Station.

Alternative 3: All stations included except Southboro

- When Southboro Station is eliminated from the analysis, both Ashland Station and the Regional Station gain ridership as one would expect. The Regional Station in this case would have about 1070 daily boardings in the year 2011. Translated into parking demand, this equals about 880 spaces, still within the proposed supply of 1000 spaces.
  There is no net loss of ridership when compared with the "All Stations" scenario.

Alternative 4: All stations included except Ashland and Southboro

- When both Ashland and Southboro stations are removed from the analysis, Framingham Station gains significant ridership, about 380 more boardings than the "All Station" scenario. The parking demand for Framingham Station would be about 800 spaces in 2011. The Regional Station would experience the highest growth in this case, with 1150 boardings and a parking demand of 940 spaces, still within the proposed supply of 1000 spaces. Eliminating Ashland and Southboro stations would

cause the ridership to decrease by 570 riders (on Worcester to Framigham segment) when compared with the "All Stations" scenario.

In all cases, the projected demand at Southboro Station is well within its proposed supply of 420 spaces. Therefore, it was not necessary to impose a parking constraint at Southboro Station and reanalyze its impact on other stations.

Non regional Station Scenario

Alternative 5: All stations included except Regional Station

- Ashland is the most heavily utilized station in 2011 with almost 950 boardings a day and a parking demand of 760 spaces. The majority of this ridership originates in Ashland and Holliston (see Table 3 and 4).

- Framingham and Southboro Station are the next most heavily used stations with parking demands of 480 and 590 spaces respectively.

- Southboro Station attracts most of its ridership from outside of its own town boundaries, namely Marlboro to the North and Hopkinton to the South. Marlboro contributes over 40% of the ridership at Southboro.

- Worcester is the third most heavily used station with a parking demand of 350. Most of this demand is from Worcester. This station also attracts riders from the widest area because of it being the terminal point on that line.

Alternative 6: All stations included except Regional and Ashland Station

- Without a station in Ashland, most of the ridership from Ashland and Holliston would get redistributed to Framingham and Southboro Stations. As a result, both of these stations would have demand far greater than the proposed parking supply. The elimination of Ashland Station results in a net loss of roughly 290 riders on the Worcester to Framingham segment, when compared to Alternative 5 (the "All Stations" scenario").

Alternative 7: All stations included except Regional and Southboro Station

- In this case, most of the ridership diverted from Southboro is redistributed primarily to Ashland with a lesser amount to Framingham and Westboro. Ashland ridership increases to over 1,400 with a parking demand of 1,150 in 2011. This exceeds the parking supply by about 450 spaces. Our analysis indicates eliminating Southboro Station would cause the ridership on the extension to decrease by 175 riders, compared to Alternative 5.

Alternative 8: All stations included except Regional and Westboro Station

- When Westboro station is eliminated from the analysis, most of the ridership from the Westboro market area is redistributed to Southboro and Grafton Stations. Both Southboro and Ashland stations would experience parking shortfall in this case.

Alternative 9: All stations included except Regional and Grafton Station

- In this case, most of the ridership diverted from Grafton is redistributed primarily to Westboro and to a lesser amount to Millbury. There is no net loss of ridership due to the elimination of Grafton Station.

Alternative 10: All stations included except Regional and Millbury Station

- The elimination of Millbury station does not result in any loss of ridership on the extension. The ridership diverted from Millbury would simply get redistributed to Grafton and Worcester.

Alternative 11: All Stations included except Regional Station, Westboro Station and Southboro Stations

- In this case, all the remaining stations would experience a ridership increase when compared to the "All Stations" scenario. Riders boarding at Grafton, Millbury and Worcester would experience a noticeable reduction in travel time as a result of the train not stopping at Westboro and Southboro stations. This travel time reduction would contribute to a slight increase in ridership at these stations compared to the "All Stations" scenario. As seen from Table 3, Ashland would experience a significant increase in boardings, about 540 more than the "All Stations" scenario. The overall loss of ridership in this alternative would be about 235 riders compared to Alternative 5.

Alternative 12: All Stations included except Regional Station, Westboro Station, Southboro and Ashland Stations

- In this case, the ridership at Framingham Station would reach about 1,970 boardings per day, about 570 more than the current observed counts. Grafton Station would experience an increase of about 140 riders compared to the "All Stations" scenario. The net loss of ridership in this case would be about 660 daily riders.

Non Regional Scenario (with a parking constraint of 420 spaces at Southboro station)

Alternative 13: All stations included except Regional Station

- When a parking constraint of 420 spaces is imposed at Southboro Station, the primary impact is felt at Ashland Station because most of the unmet demand at Southboro is diverted to Ashland Station. Our analysis indicates Ashland would attract about 135 more riders when compared with Alternative 5 which assumes unconstrained parking at Southboro Station.

Alternative 14: All stations included except Regional Station and Ashland

- When Ashland Station is removed from the analysis, the overall ridership on the extension would decrease by nearly 630 riders compared to the "All Station" unconstrained scenario. Framingham ridership would increase to 1,395 boardings which translates into 910 spaces, an increase of 430 spaces when compared with the "All Stations", unconstrained scenario.

Alternative 15: All stations included except Regional Station and Westboro

- Eliminating Westboro Station from the analysis while assuming a parking constraint at Southboro Station increases the parking demand at Ashland and Grafton by 210 and 150 spaces respectively (when compared with the 'All Stations", unconstrained scenario). There is no significant net loss of ridership due to the elimination of Westboro Station.

The Appendix of this memorandum contains several spread sheets summarizing the ridership results for all alternatives in greater detail. Forecasts are also provided for each forecast year.

cc: Yong Chang, CTPS
Jim Herlihy, Edwards and Kelcey Inc.,
Steve Davis, Rackeman Environmental Services
Geoff Slater, MBTA

Table 1

RIDERSHIP ESTIMATES FOR THE YEAR 2011 (With a Regional Station instead of local station in Westboro)

		Framingham	Ashland	Southboro	Westboro	Regional	Grafton	Millbury	Worcester	Total
	Assumption: Southboro is NOT parking constrained									
Alternative 1	All Stations	880	950	340		810	170	195	450	3,795
Alternative 2	Remove Ashland	1,230		390		960	170	195	450	3,395
Alternative 3	Remove Southboro	880	1,030			1,070	170	195	450	3,795
Alternative 4	Remove Ashland & Southboro	1,260				1,150	170	195	450	3,225

Table 2

PARKING DEMAND ESTIMATES FOR THE YEAR 2011 (With a Regional Station instead of local station in Westboro)

		Framingham	Ashland	Southboro	Westboro	Regional	Grafton	Millbury	Worcester	Total
	Assumption: Southboro is NOT parking constrained									
Alternative 1	All Stations	480	760	280		670	140	160	350	2,840
Alternative 2	Remove Ashland	770		320		790	140	160	350	2,530
Alternative 3	Remove Southboro	480	830			880	140	160	350	2,840
Alternative 4	Remove Ashland & Southboro	790				940	140	160	350	2,380

Table 3

RIDERSHIP ESTIMATES FOR THE YEAR 2011 (Without a Regional Station)

Daily Inbound Boardings

		Framingham	Ashland	Southboro	Westboro	Regional	Grafton	Millbury	Worcester	Total
	Assumption: Southboro is NOT parking constrained									
Alternative 5	All Stations	880	950	720	270		150	195	450	3,615
Alternative 6	Remove Ashland	1,230		940	270		150	195	450	3,235
Alternative 7	Remove Southboro	895	1,420		330		150	195	450	3,440
Alternative 8	Remove Westboro	880	950	870			270	195	450	3,615
Alternative 9	Remove Grafton	880	950	720	380			230	450	3,610
Alternative 10	Remove Millbury	880	950	720	270		320		470	3,610
Alternative 11	Remove Westboro and Southboro	920	1,490				275	210	485	3,380
Alternative 12	Remove Westboro, Southboro & Ashland	1,970					290	210	485	2,955
	Assumption: Southboro IS parking constrained									
Alternative 13	All Stations	880	1,085	520	265		150	195	450	3,545
Alternative 14	Remove Ashland	1,395		515	280		150	195	450	2,985
Alternative 15	Remove Westboro	880	1,210	510			330	195	450	3,575

Table 4

PARKING DEMAND ESTIMATES FOR THE YEAR 2011 (Without a Regional Station)

		Framingham	Ashland	Southboro	Westboro	Regional	Grafton	Millbury	Worcester	Total
	Assumption: Southboro is NOT parking constrained									
Alternative 5	All Stations	480	760	590	220		120	160	350	2,680
Alternative 6	Remove Ashland	770		770	220		120	160	350	2,390
Alternative 7	Remove Southboro	490	1,150		270		120	160	350	2,540
Alternative 8	Remove Westboro	480	760	710			220	160	350	2,680
Alternative 9	Remove Grafton	480	760	590	310			190	350	2,680
Alternative 10	Remove Millbury	480	760	590	220		260		370	2,680
Alternative 11	Remove Westboro & Southboro	510	1,210				230	170	380	2,500
Alternative 12	Remove Westboro, Southboro, & Ashland	1,160					230	170	380	1,940
	Assumption: Southboro IS parking constrained to 420 spaces									
Alternative 13	All Stations	480	870	420	220		120	160	350	2,620
Alternative 14	Remove Ashland	910		420	230		120	160	350	2,190
Alternative 15	Remove Westboro	480	970	420			270	160	350	2,650

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Summary of Parking Demand & Supply for all Years	
Parking Demand With a Regional Station	7
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With a Regional Station, unconstrained at Southboro	
Year 2011	
All Stations except Westboro (Local)	10
All Stations except Westboro (Local) and Ashland	11
All Stations except Westboro (Local) and Southboro	12
All Stations except Westboro (Local), Ashland, and Southboro	13
Year 2006	
All Stations except Westboro (Local)	14
All Stations except Westboro (Local) and Ashland	15
All Stations except Westboro (Local) and Southboro	16
All Stations except Westboro (Local), Ashland, and Southboro	17
Year 2001	
All Stations except Westboro (Local)	18
All Stations except Westboro (Local) and Ashland	19
All Stations except Westboro (Local) and Southboro	20
All Stations except Westboro (Local), Ashland, and Southboro	21
Year 1996	
All Stations except Westboro (Local)	22
All Stations except Westboro (Local) and Ashland	23
All Stations except Westboro (Local) and Southboro	24
All Stations except Westboro (Local), Ashland, and Southboro	25
Without a Regional Station, unconstrained at Southboro	
Year 2011	
All Stations	26
All Stations except Ashland	27
All Stations except Southboro	28
All Stations except Westboro	29
All Stations except Grafton	30
All Stations except Millbury	31
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Description	Table #
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All Stations	34
All Stations except Ashland	35
All Stations except Southboro	36
All Stations except Westboro	37
All Stations except Grafton	38
All Stations except Millbury	39
All Stations except Southboro and Westboro	40
All Stations except Ashland, Southboro, & Westboro	41
Year 2001	
All Stations	42
All Stations except Ashland	43
All Stations except Southboro	44
All Stations except Westboro	45
All Stations except Grafton	46
All Stations except Millbury	47
All Stations except Southboro and Westboro	48
All Stations except Ashland, Southboro, & Westboro	49
Year 1996	
All Stations	50
All Stations except Ashland	51
All Stations except Southboro	52
All Stations except Westboro	53
All Stations except Grafton	54
All Stations except Millbury	55
All Stations except Southboro and Westboro	56
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All Stations	58
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Year 2006	
All Stations	61
All Stations except Ashland	62
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All Stations	64
All Stations except Ashland	65
All Stations except Westboro	66
Year 1996	
All Stations	67
All Stations except Ashland	68
All Stations except Westboro	69

Table 5

Worcester Commuter Rail Extension Project II

Summary of Estimated Ridership Demand for Each Station by Year With a Regional Station

Ridership Results

Scenario	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
With a Regional Station								
Estimated Ridership								
Unconstrained at Southboro								
Year 1996 Demand								
All Stations	708	717	272	653	131	149	369	2,999
Remove Ashland	972	*****	297	774	131	149	369	2,692
Remove Southboro	708	781	*****	861	131	149	369	2,999
Remove Ashland & Southboro	994	*****	*****	924	131	149	369	2,567
Year 2001 Demand								
All Stations	742	785	293	700	143	162	392	3,217
Remove Ashland	1,030	*****	324	829	143	162	392	2,880
Remove Southboro	742	854	*****	924	143	162	392	3,217
Remove Ashland & Southboro	1,055	*****	*****	991	143	162	392	2,743
Year 2006 Demand								
All Stations	815	864	315	754	156	177	421	3,502
Remove Ashland	1,132	*****	355	892	156	177	421	3,133
Remove Southboro	815	939	*****	987	156	177	421	3,495
Remove Ashland & Southboro	1,160	*****	*****	1,066	156	177	421	2,980
Year 2011 Demand								
All Stations	881	947	341	813	170	195	448	3,795
Remove Ashland	1,228	*****	389	962	170	195	448	3,392
Remove Southboro	881	1,028	*****	1,073	170	195	448	3,795
Remove Ashland & Southboro	1,260	*****	*****	1,150	170	195	448	3,223

Table 6

Worcester Commuter Rail Extension Project II

Summary of Estimated Ridership Demand for Each Station by Year Without a Regional Station

Ridership Results

Scenario	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Without a Regional Station								
Estimated Ridership								
Unconstrained at Southboro								
Year 1996 Demand								
All Stations	709	717	566	222	115	149	369	2,847
Remove Ashland	977	*****	731	222	115	149	369	2,563
Remove Southboro	719	1,089	*****	276	115	149	369	2,717
Remove Westboro	709	717	690	*****	213	149	369	2,847
Remove Grafton	709	717	566	310	*****	175	369	2,846
Remove Millbury	709	717	566	221	248	*****	385	2,846
Remove Westboro & Southboro	736	1,156	*****	*****	215	160	399	2,666
Remove Westboro, Southboro, & Ashlan	1,363	*****	*****	*****	216	160	399	2,138
Year 2001 Demand								
All Stations	742	785	611	236	125	155	399	3,053
Remove Ashland	1,035	*****	793	236	125	155	399	2,743
Remove Southboro	753	1,192	*****	288	125	155	399	2,912
Remove Westboro	742	785	742	*****	230	155	399	3,053
Remove Grafton	742	785	611	332	*****	184	399	3,053
Remove Millbury	742	785	611	235	266	*****	414	3,053
Remove Westboro & Southboro	772	1,255	*****	*****	233	175	424	2,859
Remove Westboro, Southboro, & Ashlan	1,545	*****	*****	*****	238	175	424	2,382
Year 2006 Demand								
All Stations	814	864	662	252	136	177	421	3,326
Remove Ashland	1,137	*****	863	252	136	177	421	2,986
Remove Southboro	827	1,302	*****	310	136	177	421	3,173
Remove Westboro	814	864	801	*****	248	177	421	3,325
Remove Grafton	814	864	662	356	*****	210	421	3,327
Remove Millbury	814	864	662	251	293	*****	442	3,326
Remove Westboro & Southboro	848	1,370	*****	*****	253	192	455	3,118
Remove Westboro, Southboro, & Ashlan	1,722	*****	*****	*****	262	192	455	2,631
Year 2011 Demand								
All Stations	881	947	719	268	149	195	448	3,607
Remove Ashland	1,234	*****	940	268	149	195	448	3,234
Remove Southboro	895	1,423	*****	330	149	195	448	3,440
Remove Westboro	881	947	866	*****	270	195	448	3,607
Remove Grafton	881	947	719	382	*****	230	448	3,607
Remove Millbury	881	947	719	267	321	*****	472	3,607
Remove Westboro & Southboro	919	1,492	*****	*****	275	210	485	3,381
Remove Westboro, Southboro, & Ashlan	1,971	*****	*****	*****	286	210	485	2,952
Constrained at Southboro								
Year 1996 Demand								
All Stations	709	769	506	222	115	149	369	2,839
Remove Ashland	1,105	*****	514	241	115	149	369	2,493
Remove Westboro	709	854	508	*****	231	149	369	2,820
Year 2001 Demand								
All Stations	742	856	511	236	125	162	392	3,024
Remove Ashland	1,151	*****	515	254	125	162	392	2,599
Remove Westboro	742	934	508	*****	285	162	392	3,023
Year 2006 Demand								
All Stations	814	973	513	252	136	177	421	3,286
Remove Ashland	1,304	*****	515	262	136	177	421	2,815
Remove Westboro	815	1,061	506	*****	305	177	421	3,285
Year 2011 Demand								
All Stations	881	1,085	516	265	149	195	448	3,539
Remove Ashland	1,396	*****	515	279	149	195	448	2,982
Remove Westboro	881	1,207	510	*****	331	195	448	3,572

Table 7

Worcester Commuter Rail Extension Project II

Summary of Estimated Demand for Parking Spaces for Each Station by Year With a Regional Station

Parking Demand Results

Scenario	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
With a Regional Station								
Estimated Parking Demand								
Unconstrained at Southboro								
Year 1996 Demand								
All Stations	360	570	220	540	110	120	290	2,210
Remove Ashland	580	*****	240	640	110	120	290	1,980
Remove Southboro	360	620	*****	710	110	120	290	2,210
Remove Ashland & Southboro	600	*****	*****	760	110	120	290	1,880
Year 2001 Demand								
All Stations	370	630	240	580	120	130	300	2,370
Remove Ashland	620	*****	270	680	120	130	300	2,120
Remove Southboro	370	680	*****	760	120	130	300	2,360
Remove Ashland & Southboro	640	*****	*****	810	120	130	300	2,000
Year 2006 Demand								
All Stations	430	690	260	620	130	150	330	2,610
Remove Ashland	690	*****	290	730	130	150	330	2,320
Remove Southboro	430	750	*****	810	130	150	330	2,600
Remove Ashland & Southboro	720	*****	*****	880	130	150	330	2,210
Year 2011 Demand								
All Stations	480	760	280	670	140	160	350	2,840
Remove Ashland	770	*****	320	790	140	160	350	2,530
Remove Southboro	480	830	*****	880	140	160	350	2,840
Remove Ashland & Southboro	790	*****	*****	940	140	160	350	2,380

Table 8

Worcester Commuter Rail Extension Project II

Summary of Estimated Demand for Parking Spaces

for Each Station by Year Without a Regional Station

Parking Demand Results

Scenario	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Without a Regional Station								
Estimated Parking Demand								
Unconstrained at Southboro								
Year 1996 Demand								
All Stations	360	570	460	180	90	120	290	2,070
Remove Ashland	580	*****	600	180	90	120	290	1,860
Remove Southboro	370	880	*****	230	90	120	290	1,980
Remove Westboro	360	570	570	*****	170	120	290	2,080
Remove Grafton	360	570	460	250	*****	140	290	2,070
Remove Millbury	360	570	460	180	200	*****	300	2,070
Remove Westboro & Southboro	380	930	*****	*****	180	130	310	1,930
Remove Westboro, Southboro, & Ashlan-	690	*****	*****	*****	180	130	310	1,310
Year 2001 Demand								
All Stations	370	630	500	190	100	130	310	2,230
Remove Ashland	620	*****	650	190	100	130	310	2,000
Remove Southboro	380	960	*****	240	100	130	310	2,120
Remove Westboro	370	630	610	*****	190	130	310	2,240
Remove Grafton	370	630	500	270	*****	150	310	2,230
Remove Millbury	370	630	500	190	220	*****	320	2,230
Remove Westboro & Southboro	400	1,010	*****	*****	190	140	330	2,070
Remove Westboro, Southboro, & Ashlan-	830	*****	*****	*****	200	140	330	1,500
Year 2006 Demand								
All Stations	430	690	540	210	110	150	330	2,460
Remove Ashland	700	*****	710	210	110	150	330	2,210
Remove Southboro	440	1,050	*****	250	110	150	330	2,330
Remove Westboro	430	690	660	*****	200	150	330	2,460
Remove Grafton	430	690	540	290	*****	170	330	2,450
Remove Millbury	430	690	540	210	240	*****	350	2,460
Remove Westboro & Southboro	460	1,110	*****	*****	210	160	360	2,300
Remove Westboro, Southboro, & Ashlan-	960	*****	*****	*****	210	160	360	1,690
Year 2011 Demand								
All Stations	480	760	590	220	120	160	350	2,680
Remove Ashland	770	*****	770	220	120	160	350	2,390
Remove Southboro	490	1,150	*****	270	120	160	350	2,540
Remove Westboro	480	760	710	*****	220	160	350	2,680
Remove Grafton	480	760	590	310	*****	190	350	2,680
Remove Millbury	480	760	590	220	260	*****	370	2,680
Remove Westboro & Southboro	510	1,210	*****	*****	230	170	380	2,500
Remove Westboro, Southboro, & Ashlan-	1,160	*****	*****	*****	230	170	380	1,940
Constrained at Southboro								
Year 1996 Demand								
All Stations	360	610	420	180	90	120	290	2,070
Remove Ashland	690	*****	420	200	90	120	290	1,810
Remove Westboro	360	680	420	*****	190	120	290	2,060
Year 2001 Demand								
All Stations	370	690	420	190	100	130	300	2,200
Remove Ashland	720	*****	420	210	100	130	300	1,880
Remove Westboro	370	750	420	*****	230	130	300	2,200
Year 2006 Demand								
All Stations	430	780	420	210	110	150	330	2,430
Remove Ashland	840	*****	420	220	110	150	330	2,070
Remove Westboro	430	850	420	*****	250	150	330	2,430
Year 2011 Demand								
All Stations	480	870	420	220	120	160	350	2,620
Remove Ashland	910	*****	420	230	120	160	350	2,190
Remove Westboro	480	970	420	*****	270	160	350	2,650

Table 9

Worcester Commuter Rail Extension Project II
Summary of Parking Supply for Each Alternative

Scenario	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Proposed Parking Supply									
Without a Regional Station									
Year 1996									
All Stations	600	700	420	300	-----	250	300	500	3,070
Remove Ashland	600	-----	420	300	-----	250	300	500	2,370
Remove Southboro	600	700	-----	300	-----	250	300	500	2,650
Remove Westboro	600	700	420	-----	-----	250	300	500	2,770
Remove Grafton	600	700	420	300	-----	-----	300	500	2,820
Remove Millbury	600	700	420	300	-----	250	300	500	3,070
Remove Westboro & Southboro	600	700	-----	-----	-----	250	300	500	2,350
Remove Westboro, Southboro, & Ashlar	600	-----	-----	-----	-----	250	300	500	1,650
Year 2001 - 2011									
All Stations	700	700	420	300	-----	250	300	500	3,170
Remove Ashland	700	-----	420	300	-----	250	300	500	2,470
Remove Southboro	700	700	-----	300	-----	250	300	500	2,750
Remove Westboro	700	700	420	-----	-----	250	300	500	2,870
Remove Grafton	700	700	420	300	-----	-----	300	500	2,920
Remove Millbury	700	700	420	300	-----	250	-----	500	2,870
Remove Westboro & Southboro	700	700	-----	-----	-----	250	300	500	2,450
Remove Westboro, Southboro, & Ashlar	700	-----	-----	-----	-----	250	300	500	1,750
With a Regional Station, No Westboro (Local)									
Year 1996									
All Stations	600	700	420	-----	1,000	250	300	500	3,770
Remove Ashland	600	-----	420	-----	1,000	250	300	500	3,070
Remove Southboro	600	700	-----	-----	1,000	250	300	500	3,350
Remove Ashland & Southboro	600	-----	-----	-----	1,000	250	300	500	2,650
Year 2001 - 2011									
All Stations	700	700	420	-----	1,000	250	300	500	3,870
Remove Ashland	700	-----	420	-----	1,000	250	300	500	3,170
Remove Southboro	700	700	-----	-----	1,000	250	300	500	3,450
Remove Ashland & Southboro	700	-----	-----	-----	1,000	250	300	500	2,750

Table 10

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
All Stations / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							**734**
Holliston	37	345						**382**
Ashland	28	523						**551**
Southboro		27	98	31				**156**
Hopkinton		52	70	52				**174**
Marlboro			63	251				**314**
Milford				72				**72**
Upton			83	55				**138**
Hudson				49				**49**
Berlin				5				**5**
Bolton				20				**20**
Clinton				42				**42**
Westboro			28	64				**92**
Northboro				109				**109**
Shrewsbury				62	45			**107**
Grafton					50			**50**
Sutton					20			**20**
Boylston					20			**20**
Northbridge					35			**35**
Oxford						23		**23**
Charlton						20		**20**
Millbury						30		**30**
Auburn						51	34	**85**
Worcester						71	284	**355**
Holden							67	**67**
Paxton							13	**13**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							40	**40**
Other	82							**82**
Total	**881**	**947**	**341**	**813**	**170**	**195**	**448**	**3,795**
Person Trips by Mode of Access								
Walk	294	20	0	0	0	0	20	**334**
Kiss'n'Ride	53	76	27	65	14	16	36	**286**
Park'n'Ride	534	851	314	748	156	179	392	**3,175**
Parking Spaces								
Demand	**480**	**760**	**280**	**670**	**140**	**160**	**350**	**2,840**
Supply	700	700	420	1000	250	300	500	**3,870**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
Remove Ashland / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							**734**
Holliston	162		18					**180**
Ashland	221		130					**350**
Southboro			125	31				**156**
Hopkinton	30		66	78				**174**
Marlboro				314				**314**
Milford				72				**72**
Upton			28	110				**138**
Hudson				49				**49**
Berlin				5				**5**
Bolton				20				**20**
Clinton				42				**42**
Westboro			23	69				**92**
Northboro				109				**109**
Shrewsbury				62	45			**107**
Grafton					50			**50**
Sutton					20			**20**
Boylston					20			**20**
Northbridge					35			**35**
Oxford						23		**23**
Charlton						20		**20**
Millbury						30		**30**
Auburn						51	34	**85**
Worcester						71	284	**355**
Holden							67	**67**
Paxton							13	**13**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							40	**40**
Other	82							**82**
Total	**1,228**		**389**	**962**	**170**	**195**	**448**	**3,392**
Person Trips by Mode of Access								
Walk	294		0	0	0	0	20	**314**
Kiss'n'Ride	74		31	77	14	16	36	**247**
Park'n'Ride	860		358	885	156	179	392	**2,831**
Parking Spaces								
Demand	**770**		**320**	**790**	**140**	**160**	**350**	**2,530**
Supply	700		420	1000	250	300	500	**3,170**

Table 12

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
Remove Southboro / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							**734**
Holliston	37	345						**382**
Ashland	28	523						**551**
Southboro		62		94				**156**
Hopkinton		70		104				**174**
Marlboro				314				**314**
Milford				72				**72**
Upton		28		110				**138**
Hudson				49				**49**
Berlin				5				**5**
Bolton				20				**20**
Clinton				42				**42**
Westboro				92				**92**
Northboro				109				**109**
Shrewsbury				62	45			**107**
Grafton					50			**50**
Sutton					20			**20**
Boylston					20			**20**
Northbridge					35			**35**
Oxford						23		**23**
Charlton						20		**20**
Millbury						30		**30**
Auburn						51	34	**85**
Worcester						71	284	**355**
Holden							67	**67**
Paxton							13	**13**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							40	**40**
Other	82							**82**
Total	**881**	**1,028**		**1,073**	**170**	**195**	**448**	**3,795**
Person Trips by Mode of Access								
Walk	294	20		0	0	0	20	**334**
Kiss'n'Ride	53	82		86	14	16	36	**286**
Park'n'Ride	534	926		988	156	179	392	**3,175**
Parking Spaces								
Demand	**480**	**830**		**880**	**140**	**160**	**350**	**2,840**
Supply	700	700		1000	250	300	500	**3,450**

Table 13

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
Remove Ashland & Southboro / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							734
Holliston	162			18				180
Ashland	250							250
Southboro	17			94				111
Hopkinton	15			134				149
Marlboro				314				314
Milford				72				72
Upton				138				138
Hudson				49				49
Berlin				5				5
Bolton				20				20
Clinton				42				42
Westboro				92				92
Northboro				109				109
Shrewsbury				62	45			107
Grafton					50			50
Sutton					20			20
Boylston					20			20
Northbridge					35			35
Oxford						23		23
Charlton						20		20
Millbury						30		30
Auburn						51	34	85
Worcester						71	284	355
Holden							67	67
Paxton							13	13
Spencer							5	5
Leicester							5	5
W.Boylston							40	40
Other	82							82
Total	**1,260**			**1,150**	**170**	**195**	**448**	**3,222**
Person Trips by Mode of Access								
Walk	294			0	0	0	20	314
Kiss'n'Ride	76			92	14	16	36	233
Park'n'Ride	890			1058	156	179	392	2,675
Parking Spaces								
Demand	**790**			**940**	**140**	**160**	**350**	2,380
Supply	700			1000	250	300	500	2,750

Table 14

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
All Stations / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	34	321						**355**
Ashland	25	471						**496**
Southboro		24	88	28				**140**
Hopkinton		49	65	49				**162**
Marlboro			57	229				**286**
Milford				68				**68**
Upton			79	52				**131**
Hudson				46				**46**
Berlin				5				**5**
Bolton				18				**18**
Clinton				39				**39**
Westboro			26	62				**88**
Northboro				102				**102**
Shrewsbury				57	41			**98**
Grafton					45			**45**
Sutton					18			**18**
Boylston					19			**19**
Northbridge					32			**32**
Oxford						21		**21**
Charlton						19		**19**
Millbury						29		**29**
Auburn						41	27	**68**
Worcester						68	273	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**815**	**864**	**315**	**754**	**156**	**177**	**421**	**3,502**
Person Trips by Mode of Access								
Walk	287	20	0	0	0	0	20	**327**
Kiss'n'Ride	49	69	25	60	12	14	34	**264**
Park'n'Ride	479	775	290	694	143	163	367	**2,911**
Parking Spaces								
Demand	**430**	**690**	**260**	**620**	**130**	**150**	**330**	**2,610**
Supply	700	700	420	1000	250	300	500	**3,870**

Table 15

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
Remove Ashland / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	151		17					**167**
Ashland	198		117					**315**
Southboro			112	28				**140**
Hopkinton	28		61	73				**162**
Marlboro				286				**286**
Milford				68				**68**
Upton			26	105				**131**
Hudson				46				**46**
Berlin				5				**5**
Bolton				18				**18**
Clinton				39				**39**
Westboro			22	66				**88**
Northboro				102				**102**
Shrewsbury				57	41			**98**
Grafton					45			**45**
Sutton					18			**18**
Boylston					19			**19**
Northbridge					32			**32**
Oxford						21		**21**
Charlton						19		**19**
Millbury						29		**29**
Auburn						41	27	**68**
Worcester						68	273	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**1,132**		**355**	**892**	**156**	**177**	**421**	**3,134**
Person Trips by Mode of Access								
Walk	287		0	0	0	0	20	**307**
Kiss'n'Ride	68		28	71	12	14	34	**228**
Park'n'Ride	777		327	821	143	163	367	**2,598**
Parking Spaces								
Demand	**690**		**290**	**730**	**130**	**150**	**330**	**2,320**
Supply	700		420	1000	250	300	500	**3,170**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
Remove Southboro / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	34	321						**355**
Ashland	25	471						**496**
Southboro		56		84				**140**
Hopkinton		65		97				**162**
Marlboro				286				**286**
Milford				68				**68**
Upton		26		105				**131**
Hudson				46				**46**
Berlin				5				**5**
Bolton				18				**18**
Clinton				39				**39**
Westboro				85				**85**
Northboro				98				**98**
Shrewsbury				57	41			**98**
Grafton					45			**45**
Sutton					18			**18**
Boylston					19			**19**
Northbridge					32			**32**
Oxford						21		**21**
Charlton						19		**19**
Millbury						29		**29**
Auburn						41	27	**68**
Worcester						68	273	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**815**	**939**		**987**	**156**	**177**	**421**	**3,494**
Person Trips by Mode of Access								
Walk	287	20		0	0	0	20	**327**
Kiss'n'Ride	49	75		79	12	14	34	**263**
Park'n'Ride	479	844		908	143	163	367	**2,904**
Parking Spaces								
Demand	**430**	**750**		**810**	**130**	**150**	**330**	**2,600**
Supply	700	700		1000	250	300	500	**3,450**

Table 17

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
Remove Ashland & Southboro / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							681
Holliston	151			17				167
Ashland	225							225
Southboro	15			85				100
Hopkinton	14			125				139
Marlboro				286				286
Milford				68				68
Upton				131				131
Hudson				46				46
Berlin				5				5
Bolton				18				18
Clinton				39				39
Westboro				88				88
Northboro				102				102
Shrewsbury				57	41			98
Grafton					45			45
Sutton					18			18
Boylston					19			19
Northbridge					32			32
Oxford						21		21
Charlton						19		19
Millbury						29		29
Auburn						41	27	68
Worcester						68	273	341
Holden							62	62
Paxton							12	12
Spencer							5	5
Leicester							5	5
W.Boylston							37	37
Other	74							74
Total	**1,160**			**1,066**	**156**	**177**	**421**	**2,980**
Person Trips by Mode of Access								
Walk	287			0	0	0	20	307
Kiss'n'Ride	70			85	12	14	34	215
Park'n'Ride	803			981	143	163	367	2,458
Parking Spaces								
Demand	**720**			**880**	**130**	**150**	**330**	2,210
Supply	700			1000	250	300	500	2,750

Table 18

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
All Stations / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	32	300						**332**
Ashland	22	419						**441**
Southboro		21	80	25				**126**
Hopkinton		45	60	45				**150**
Marlboro			52	208				**261**
Milford				64				**64**
Upton			75	50				**126**
Hudson				42				**42**
Berlin				5				**5**
Bolton				17				**17**
Clinton				36				**36**
Westboro			26	60				**86**
Northboro				96				**96**
Shrewsbury				52	38			**90**
Grafton					41			**41**
Sutton					17			**17**
Boylston					18			**18**
Northbridge					30			**30**
Oxford						19		**19**
Charlton						18		**18**
Millbury						27		**27**
Auburn						33	22	**54**
Worcester						65	258	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	70							**70**
Total	**742**	**785**	**293**	**700**	**143**	**162**	**392**	**3,216**
Person Trips by Mode of Access								
Walk	279	20	0	0	0	0	20	**319**
Kiss'n'Ride	45	63	23	56	11	13	31	**242**
Park'n'Ride	418	702	269	644	131	149	341	**2,655**
Parking Spaces								
Demand	**370**	**630**	**240**	**580**	**120**	**130**	**300**	**2,370**
Supply	700	700	420	1000	250	300	500	**3,870**

Table 19

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
Remove Ashland / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							618
Holliston	141		16					157
Ashland	176		104					280
Southboro			101	25				126
Hopkinton	25		57	67				150
Marlboro				261				261
Milford				64				64
Upton			25	100				126
Hudson				42				42
Berlin				5				5
Bolton				17				17
Clinton				36				36
Westboro			21	64				86
Northboro				96				96
Shrewsbury				52	38			90
Grafton					41			41
Sutton					17			17
Boylston					18			18
Northbridge					30			30
Oxford						19		19
Charlton						18		18
Millbury						27		27
Auburn						33	22	54
Worcester						65	258	323
Holden							58	58
Paxton							11	11
Spencer							4	4
Leicester							4	4
W.Boylston							34	34
Other	70							70
Total	**1,030**		**324**	**829**	**143**	**162**	**392**	**2,880**
Person Trips by Mode of Access								
Walk	279		0	0	0	0	20	299
Kiss'n'Ride	62		26	66	11	13	31	210
Park'n'Ride	689		298	763	131	149	341	2,371
Parking Spaces								
Demand	**620**		**270**	**680**	**120**	**130**	**300**	**2,120**
Supply	700		420	1000	250	300	500	3,170

Table 20

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
Remove Southboro / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	32	300						**332**
Ashland	22	419						**441**
Southboro		51		76				**126**
Hopkinton		60		90				**150**
Marlboro				261				**261**
Milford				64				**64**
Upton		25		100				**126**
Hudson				42				**42**
Berlin				5				**5**
Bolton				17				**17**
Clinton				36				**36**
Westboro				86				**86**
Northboro				96				**96**
Shrewsbury				52	38			**90**
Grafton					41			**41**
Sutton					17			**17**
Boylston					18			**18**
Northbridge					30			**30**
Oxford						19		**19**
Charlton						18		**18**
Millbury						27		**27**
Auburn						33	22	**54**
Worcester						65	258	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	70							**70**
Total	**742**	**854**		**924**	**143**	**162**	**392**	**3,216**
Person Trips by Mode of Access								
Walk	279	20		0	0	0	20	**319**
Kiss'n'Ride	45	68		74	11	13	31	**242**
Park'n'Ride	418	766		850	131	149	341	**2,655**
Parking Spaces								
Demand	**370**	**680**		**760**	**120**	**130**	**300**	**2,360**
Supply	700	700		1000	250	300	500	**3,450**

Table 21

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
Remove Ashland & Southboro / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	141			16				**157**
Ashland	200							**200**
Southboro	13			76				**90**
Hopkinton	13			115				**128**
Marlboro				261				**261**
Milford				64				**64**
Upton				126				**126**
Hudson				42				**42**
Berlin				5				**5**
Bolton				17				**17**
Clinton				36				**36**
Westboro				86				**86**
Northboro				96				**96**
Shrewsbury				52	38			**90**
Grafton					41			**41**
Sutton					17			**17**
Boylston					18			**18**
Northbridge					30			**30**
Oxford						19		**19**
Charlton						18		**18**
Millbury						27		**27**
Auburn						33	22	**54**
Worcester						65	258	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	70							**70**
Total	**1,055**			**991**	**143**	**162**	**392**	**2,742**
Person Trips by Mode of Access								
Walk	279			0	0	0	20	**299**
Kiss'n'Ride	63			79	11	13	31	**198**
Park'n'Ride	712			912	131	149	341	**2,244**
Parking Spaces								
Demand	**640**			**810**	**120**	**130**	**300**	**2,000**
Supply	700			1000	250	300	500	**2,750**

Table 22

Estimated Daily Inbound Commuter Rail Trips to Boston CBD and East Cambridge, Year 1996
All Stations / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	30	279						**309**
Ashland	20	377						**397**
Southboro		19	72	23				**114**
Hopkinton		42	56	42				**139**
Marlboro			48	191				**239**
Milford				60				**60**
Upton			72	48				**120**
Hudson				39				**39**
Berlin				4				**4**
Bolton				16				**16**
Clinton				33				**33**
Westboro			25	58				**83**
Northboro				90				**90**
Shrewsbury				48	35			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**708**	**717**	**272**	**653**	**131**	**149**	**369**	**2,999**
Person Trips by Mode of Access								
Walk	265	20	0	0	0	0	20	**305**
Kiss'n'Ride	43	57	22	52	10	12	29	**226**
Park'n'Ride	401	640	250	601	121	137	319	**2,468**
Parking Spaces								
Demand	**360**	**570**	**220**	**540**	**110**	**120**	**290**	**2,210**
Supply	600	700	420	1000	250	300	500	**3,770**

Table 23

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
Remove Ashland / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	131		15					**146**
Ashland	159		93					**252**
Southboro			91	23				**114**
Hopkinton	24		53	63				**139**
Marlboro				239				**239**
Milford				60				**60**
Upton			24	96				**120**
Hudson				39				**39**
Berlin				4				**4**
Bolton				16				**16**
Clinton				33				**33**
Westboro			21	62				**83**
Northboro				90				**90**
Shrewsbury				48	35			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**972**		**297**	**774**	**131**	**149**	**369**	**2,691**
Person Trips by Mode of Access								
Walk	265		0	0	0	0	20	**285**
Kiss'n'Ride	58		24	62	10	12	29	**196**
Park'n'Ride	649		273	712	121	137	319	**2,210**
Parking Spaces								
Demand	**580**		**240**	**640**	**110**	**120**	**290**	**1,980**
Supply	600		420	1000	250	300	500	**3,070**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
Remove Southboro / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	30	279						**309**
Ashland	20	377						**397**
Southboro		46		68				**114**
Hopkinton		56		84				**139**
Marlboro				239				**239**
Milford				60				**60**
Upton		24		96				**120**
Hudson				39				**39**
Berlin				4				**4**
Bolton				16				**16**
Clinton				33				**33**
Westboro				83				**83**
Northboro				90				**90**
Shrewsbury				48	35			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**708**	**781**		**861**	**131**	**149**	**369**	**2,999**
Person Trips by Mode of Access								
Walk	265	20		0	0	0	20	**305**
Kiss'n'Ride	43	63		69	10	12	29	**226**
Park'n'Ride	401	699		792	121	137	319	**2,468**
Parking Spaces								
Demand	**360**	**620**		**710**	**110**	**120**	**290**	**2,210**
Supply	600	700		1000	250	300	500	**3,350**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
Remove Ashland & Southboro / No Constraint in Southboro
With Regional Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	131			15				**146**
Ashland	180							**180**
Southboro	12			69				**81**
Hopkinton	12			107				**119**
Marlboro				239				**239**
Milford				60				**60**
Upton				120				**120**
Hudson				39				**39**
Berlin				4				**4**
Bolton				16				**16**
Clinton				33				**33**
Westboro				83				**83**
Northboro				90				**90**
Shrewsbury				48	35			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**994**			**924**	**131**	**149**	**369**	**2,566**
Person Trips by Mode of Access								
Walk	265			0	0	0	20	**285**
Kiss'n'Ride	60			74	10	12	29	**185**
Park'n'Ride	669			850	121	137	319	**2,095**
Parking Spaces								
Demand	**600**			**760**	**110**	**120**	**290**	**1,880**
Supply	600			1000	250	300	500	**2,650**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
All Stations / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							734
Holliston	37	345						382
Ashland	28	523						551
Southboro		27	129					156
Hopkinton		52	122					174
Marlboro			314					314
Upton			109	29				138
Westboro			45	47				92
Northboro				109				109
Shrewsbury				83	24			107
Grafton					50			50
Sutton					20			20
Boylston					20			20
Northbridge					35			35
Oxford						23		23
Charlton						20		20
Millbury						30		30
Auburn						51	34	85
Worcester						71	284	355
Holden							67	67
Paxton							13	13
Spencer							5	5
Leicester							5	5
W.Boylston							40	40
Other	82							82
Total	**881**	**947**	**719**	**268**	**149**	**195**	**448**	**3,607**
Person Trips by Mode of Access								
Walk	294	20	0	0	0	0	20	334
Kiss'n'Ride	53	76	58	21	12	16	36	271
Park'n'Ride	534	851	662	247	137	179	392	3,002
Parking Spaces								
Demand	**480**	**760**	**590**	**220**	**120**	**160**	**350**	**2,680**
Supply	700	700	420	300	250	300	500	3,170

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
Remove Ashland / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							**734**
Holliston	168		42					**210**
Ashland	220		130					**350**
Southboro			156					**156**
Hopkinton	30		144					**174**
Marlboro			314					**314**
Upton			109	29				**138**
Westboro			45	47				**92**
Northboro				109				**109**
Shrewsbury				83	24			**107**
Grafton					50			**50**
Sutton					20			**20**
Boylston					20			**20**
Northbridge					35			**35**
Oxford						23		**23**
Charlton						20		**20**
Millbury						30		**30**
Auburn						51	34	**85**
Worcester						71	284	**355**
Holden							67	**67**
Paxton							13	**13**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							40	**40**
Other	82							**82**
Total	**1,234**		**940**	**268**	**149**	**195**	**448**	**3,234**
Person Trips by Mode of Access								
Walk	294		0	0	0	0	20	**314**
Kiss'n'Ride	74		75	21	12	16	36	**234**
Park'n'Ride	866		865	247	137	179	392	**2,686**
Parking Spaces								
Demand	**770**		**770**	**220**	**120**	**160**	**350**	**2,390**
Supply	700		420	300	250	300	500	**2,470**

Table 28

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
Remove Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							**734**
Holliston	37	345						**382**
Ashland	28	523						**551**
Southboro		156						**156**
Hopkinton		174						**174**
Marlboro	14	151		9				**174**
Upton		55		55				**110**
Westboro		18		74				**92**
Northboro				109				**109**
Shrewsbury				83	24			**107**
Grafton					50			**50**
Sutton					20			**20**
Boylston					20			**20**
Northbridge					35			**35**
Oxford						23		**23**
Charlton						20		**20**
Millbury						30		**30**
Auburn						51	34	**85**
Worcester						71	284	**355**
Holden							67	**67**
Paxton							13	**13**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							40	**40**
Other	82							**82**
Total	**895**	**1,423**		**330**	**149**	**195**	**448**	**3,439**
Person Trips by Mode of Access								
Walk	294	20		0	0	0	20	**334**
Kiss'n'Ride	54	114		26	12	16	36	**257**
Park'n'Ride	547	1289		304	137	179	392	**2,848**
Parking Spaces								
Demand	**490**	**1150**		**270**	**120**	**160**	**350**	**2,540**
Supply	700	700		300	250	300	500	**2,750**

Table 29

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
Remove Westboro / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							**734**
Holliston	37	345						**382**
Ashland	28	523						**551**
Southboro		27	129					**156**
Hopkinton		52	122					**174**
Marlboro			314					**314**
Upton			138					**138**
Westboro			72		20			**92**
Northboro			70		39			**109**
Shrewsbury			21		86			**107**
Grafton					50			**50**
Sutton					20			**20**
Boylston					20			**20**
Northbridge					35			**35**
Oxford						23		**23**
Charlton						20		**20**
Millbury						30		**30**
Auburn						51	34	**85**
Worcester						71	284	**355**
Holden							67	**67**
Paxton							13	**13**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							40	**40**
Other	82							**82**
Total	**881**	**947**	**866**		**270**	**195**	**448**	**3,607**
Person Trips by Mode of Access								
Walk	294	20	0		0	0	20	**334**
Kiss'n'Ride	53	76	69		22	16	36	**271**
Park'n'Ride	534	851	797		248	179	392	**3,002**
Parking Spaces								
Demand	**480**	**760**	**710**		**220**	**160**	**350**	**2,680**
Supply	700	700	420		250	300	500	**2,870**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
Remove Grafton / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							**734**
Holliston	37	345						**382**
Ashland	28	523						**551**
Southboro		27	129					**156**
Hopkinton		52	122					**174**
Marlboro			314					**314**
Upton			109	29				**138**
Westboro			45	47				**92**
Northboro				109				**109**
Shrewsbury				102		5		**107**
Grafton				40		10		**50**
Sutton						20		**20**
Boylston				20				**20**
Northbridge				35				**35**
Oxford						23		**23**
Charlton						20		**20**
Millbury						30		**30**
Auburn						51	34	**85**
Worcester						71	284	**355**
Holden							67	**67**
Paxton							13	**13**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							40	**40**
Other	82							**82**
Total	**881**	**947**	**719**	**382**		**230**	**448**	**3,607**
Person Trips by Mode of Access								
Walk	294	20	0	0		0	20	**334**
Kiss'n'Ride	53	76	58	31		18	36	**271**
Park'n'Ride	534	851	662	351		212	392	**3,002**
Parking Spaces								
Demand	**480**	**760**	**590**	**310**		**190**	**350**	**2,680**
Supply	700	700	420	300		300	500	**2,920**

Table 31

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
Remove Millbury / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							**734**
Holliston	37	345						**382**
Ashland	28	523						**551**
Southboro		27	129					**156**
Hopkinton		52	122					**174**
Marlboro			314					**314**
Upton			109	29				**138**
Westboro			45	47				**92**
Northboro				109				**109**
Shrewsbury				82	25			**107**
Grafton					50			**50**
Sutton					20			**20**
Boylston					20			**20**
Northbridge					35			**35**
Oxford					18		5	**23**
Charlton					15		5	**20**
Millbury					30			**30**
Auburn					51		34	**85**
Worcester					57		298	**355**
Holden							67	**67**
Paxton							13	**13**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							40	**40**
Other	**82**							**82**
Total	**881**	**947**	**719**	**267**	**321**		**472**	**3,607**
Person Trips by Mode of Access								
Walk	294	20	0	0	0		20	**334**
Kiss'n'Ride	53	76	58	21	26		38	**271**
Park'n'Ride	534	851	662	246	295		414	**3,002**
Parking Spaces								
Demand	**480**	**760**	**590**	**220**	**260**		**370**	**2,680**
Supply	700	700	420	300	250		500	**2,870**

Table 32

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
All Stations Except Regional, Westboro, and Southboro Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin									
Framingham	734								**734**
Holliston	30	352							**382**
Ashland	28	523							**551**
Southboro	28	105							**133**
Hopkinton		156							**156**
Marlboro	17	157							**174**
Upton		64				9			**73**
Westboro		85				7			**92**
Northboro		50				21			**71**
Shrewsbury						104			**104**
Grafton						54			**54**
Sutton						21			**21**
Boylston						21			**21**
Northbridge						37			**37**
Oxford							25		**25**
Charlton							22		**22**
Millbury							32		**32**
Auburn							55	37	**92**
Worcester							77	308	**384**
Holden								73	**73**
Paxton								14	**14**
Spencer								5	**5**
Leicester								5	**5**
W.Boylston								43	**43**
Other	82								**82**
Total	**919**	**1,492**				**275**	**210**	**485**	**3,381**
Person Trips by Mode of Access									
Walk	294	20				0	0	20	**334**
Kiss'n'Ride	55	119				22	17	39	**252**
Park'n'Ride	570	1352				253	194	426	**2,795**
Parking Spaces									
Demand	**510**	**1210**				**230**	**170**	**380**	**2,500**
Supply	700	700				250	300	500	**2,450**

Table 33

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
No Constraint in Southboro
All Stations Except Regional, Westboro, Southboro, & Ashland Stations

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin									
Framingham	734								734
Holliston	226								226
Ashland	326								326
Southboro	152								152
Hopkinton	182								182
Marlboro	40								40
Upton	36					7			43
Westboro	97					11			108
Northboro	97					19			116
Shrewsbury						115			115
Grafton						54			54
Sutton						21			21
Boylston						21			21
Northbridge						37			37
Oxford							25		25
Charlton							22		22
Millbury							32		32
Auburn							55	37	92
Worcester							77	308	384
Holden								73	73
Paxton								14	14
Spencer								5	5
Leicester								5	5
W.Boylston								43	43
Other	82								82
Total	**1,971**					**286**	**210**	**485**	**2,951**
Person Trips by Mode of Access									
Walk	294					0	0	20	314
Kiss'n'Ride	375					23	17	39	453
Park'n'Ride	1,303					263	194	426	2,185
Parking Spaces									
Demand	**1,160**					**230**	**170**	**380**	**1,940**
Supply	700					250	300	500	1,750

Table 34

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
All Stations / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	34	321						**355**
Ashland	25	471						**496**
Southboro		24	117					**140**
Hopkinton		49	113					**162**
Marlboro			286					**286**
Upton			104	28				**131**
Westboro			43	45				**88**
Northboro				102				**102**
Shrewsbury				77	22			**98**
Grafton					45			**45**
Sutton					18			**18**
Boylston					19			**19**
Northbridge					32			**32**
Oxford						21		**21**
Charlton						19		**19**
Millbury						29		**29**
Auburn						41	27	**68**
Worcester						68	273	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**814**	**864**	**662**	**252**	**136**	**177**	**421**	**3,327**
Person Trips by Mode of Access								
Walk	287	20	0	0	0	0	20	**327**
Kiss'n'Ride	49	69	53	20	11	14	34	**250**
Park'n'Ride	478	775	609	232	125	163	367	**2,750**
Parking Spaces								
Demand	**430**	**690**	**540**	**210**	**110**	**150**	**330**	**2,460**
Supply	700	700	420	300	250	300	500	**3,170**

Table 35

Worcetsre Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
Remove Ashland / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	156		39					**195**
Ashland	198		117					**315**
Southboro			140					**140**
Hopkinton	28		134					**162**
Marlboro			286					**286**
Upton			104	28				**131**
Westboro			43	45				**88**
Northboro				102				**102**
Shrewsbury				77	22			**98**
Grafton					45			**45**
Sutton					18			**18**
Boylston					19			**19**
Northbridge					32			**32**
Oxford						21		**21**
Charlton						19		**19**
Millbury						29		**29**
Auburn						41	27	**68**
Worcester						68	273	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**1,137**		**863**	**252**	**136**	**177**	**421**	**2,986**
Person Trips by Mode of Access								
Walk	287		0	0	0	0	20	**307**
Kiss'n'Ride	68		69	20	11	14	34	**216**
Park'n'Ride	782		794	232	125	163	367	**2,463**
Parking Spaces								
Demand	**700**		**710**	**210**	**110**	**150**	**330**	**2,210**
Supply	700		420	300	250	300	500	**2,470**

Table 36

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
Remove Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	34	321						**355**
Ashland	25	471						**496**
Southboro		140						**140**
Hopkinton		162						**162**
Marlboro	13	138		8				**158**
Upton		52		52				**105**
Westboro		18		71				**88**
Northboro				102				**102**
Shrewsbury				77	22			**98**
Grafton					45			**45**
Sutton					18			**18**
Boylston					19			**19**
Northbridge					32			**32**
Oxford						21		**21**
Charlton						19		**19**
Millbury						29		**29**
Auburn						41	27	**68**
Worcester						68	273	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**827**	**1,302**		**310**	**136**	**177**	**421**	**3,174**
Person Trips by Mode of Access								
Walk	287	20		0	0	0	20	**327**
Kiss'n'Ride	50	104		25	11	14	34	**237**
Park'n'Ride	490	1178		285	125	163	367	**2,609**
Parking Spaces								
Demand	**440**	**1050**		**250**	**110**	**150**	**330**	**2,330**
Supply	700	700		300	250	300	500	**2,750**

Table 37

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
Remove Westboro / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	34	321						**355**
Ashland	25	471						**496**
Southboro		24	117					**140**
Hopkinton		49	113					**162**
Marlboro			286					**286**
Upton			131					**131**
Westboro			69		19			**88**
Northboro			66		37			**102**
Shrewsbury			20		78			**98**
Grafton					45			**45**
Sutton					18			**18**
Boylston					19			**19**
Northbridge					32			**32**
Oxford						21		**21**
Charlton						19		**19**
Millbury						29		**29**
Auburn						41	27	**68**
Worcester						68	273	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**815**	**864**	**801**		**248**	**177**	**421**	**3,327**
Person Trips by Mode of Access								
Walk	287	20	0		0	0	20	**327**
Kiss'n'Ride	49	69	64		20	14	34	**250**
Park'n'Ride	479	775	737		228	163	367	**2,749**
Parking Spaces								
Demand	**430**	**690**	**660**		**200**	**150**	**330**	**2,460**
Supply	700	700	420		250	300	500	**2,870**

Table 38

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
Remove Grafton / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	34	321						**355**
Ashland	25	471						**496**
Southboro		24	117					**140**
Hopkinton		49	113					**162**
Marlboro			286					**286**
Upton			104	28				**131**
Westboro			43	45				**88**
Northboro				102				**102**
Shrewsbury				94		5		**98**
Grafton				36		9		**45**
Sutton						18		**18**
Boylston				19				**19**
Northbridge				32				**32**
Oxford						21		**21**
Charlton						19		**19**
Millbury						29		**29**
Auburn						41	27	**68**
Worcester						68	273	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**815**	**864**	**662**	**356**		**210**	**421**	**3,327**
Person Trips by Mode of Access								
Walk	287	20	0	0		0	20	**327**
Kiss'n'Ride	49	69	53	28		17	34	**250**
Park'n'Ride	479	775	609	327		193	367	**2,750**
Parking Spaces								
Demand	**430**	**690**	**540**	**290**		**170**	**330**	**2,450**
Supply	700	700	420	300		300	500	**2,920**

Table 39

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
Remove Millbury / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	34	321						**355**
Ashland	25	471						**496**
Southboro		24	117					**140**
Hopkinton		49	113					**162**
Marlboro			286					**286**
Upton			104	28				**131**
Westboro			43	45				**88**
Northboro				102				**102**
Shrewsbury				76	23			**98**
Grafton					45			**45**
Sutton					18			**18**
Boylston					19			**19**
Northbridge					32			**32**
Oxford					17		4	**21**
Charlton					15		4	**19**
Millbury					29			**29**
Auburn					41		27	**68**
Worcester					55		286	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**815**	**864**	**662**	**251**	**293**		**442**	**3,327**
Person Trips by Mode of Access								
Walk	287	20	0	0	0		20	**327**
Kiss'n'Ride	49	69	53	20	23		35	**250**
Park'n'Ride	479	775	609	231	270		387	**2,750**
Parking Spaces								
Demand	**430**	**690**	**540**	**210**	**240**		**350**	**2,460**
Supply	700	700	420	300	250		500	**2,870**

Table 40

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
All Stations Except Regional, Westboro, and Southboro Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin									
Framingham	681								**681**
Holliston	27	328							**355**
Ashland	25	471							**496**
Southboro	25	95							**120**
Hopkinton		145							**145**
Marlboro	16	143							**158**
Upton		61				8			**69**
Westboro		81				7			**88**
Northboro		47				20			**67**
Shrewsbury						96			**96**
Grafton						48			**48**
Sutton						20			**20**
Boylston						20			**20**
Northbridge						34			**34**
Oxford							23		**23**
Charlton							20		**20**
Millbury							31		**31**
Auburn							44	29	**73**
Worcester							74	295	**369**
Holden								67	**67**
Paxton								13	**13**
Spencer								5	**5**
Leicester								5	**5**
W.Boylston								40	**40**
Other	74								**74**
Total	**848**	**1,370**				**253**	**192**	**455**	**3,119**
Person Trips by Mode of Access									
Walk	287	20				0	0	20	**327**
Kiss'n'Ride	51	110				20	15	36	**233**
Park'n'Ride	510	1240				233	176	399	**2,559**
Parking Spaces									
Demand	**460**	**1110**				**210**	**160**	**360**	**2,300**
Supply	700	700				250	300	500	**2,450**

Table 41

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
No Constraint in Southboro
All Stations Except Regional, Westboro, Southboro, & Ashland Stations

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin									
Framingham	681								681
Holliston	181								181
Ashland	261								261
Southboro	125								125
Hopkinton	162								162
Marlboro	32								32
Upton	31					6			37
Westboro	88					10			98
Northboro	88					17			105
Shrewsbury						105			105
Grafton						48			48
Sutton						20			20
Boylston						20			20
Northbridge						34			34
Oxford							23		23
Charlton							20		20
Millbury							31		31
Auburn							44	29	73
Worcester							74	295	369
Holden								67	67
Paxton								13	13
Spencer								5	5
Leicester								5	5
W.Boylston								40	40
Other	74								74
Total	**1,722**					**261**	**192**	**455**	**2,631**
Person Trips by Mode of Access									
Walk	287					0	0	20	307
Kiss'n'Ride	362					21	15	36	434
Park'n'Ride	1,073					240	176	399	1,889
Parking Spaces									
Demand	**960**					**210**	**160**	**360**	**1,690**
Supply	700					250	300	500	1,750

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
All Stations / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	32	300						**332**
Ashland	22	419						**441**
Southboro		21	105					**126**
Hopkinton		45	105					**150**
Marlboro			261					**261**
Upton			99	26				**126**
Westboro			42	44				**86**
Northboro				96				**96**
Shrewsbury				70	20			**90**
Grafton					41			**41**
Sutton					17			**17**
Boylston					18			**18**
Northbridge					30			**30**
Oxford						19		**19**
Charlton						18		**18**
Millbury						27		**27**
Auburn						26	28	**54**
Worcester						65	258	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	70							**70**
Total	**742**	**785**	**611**	**236**	**125**	**155**	**399**	**3,053**
Person Trips by Mode of Access								
Walk	279	20	0	0	0	0	20	**319**
Kiss'n'Ride	45	63	49	19	10	12	32	**229**
Park'n'Ride	419	702	562	217	115	143	347	**2,505**
Parking Spaces								
Demand	**370**	**630**	**500**	**190**	**100**	**130**	**310**	**2,230**
Supply	700	700	420	300	250	300	500	**3,170**

Table 43

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
Remove Ashland / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	146		37					**183**
Ashland	176		104					**280**
Southboro			126					**126**
Hopkinton	26		124					**150**
Marlboro			261					**261**
Upton			99	26				**126**
Westboro			42	44				**86**
Northboro				96				**96**
Shrewsbury				70	20			**90**
Grafton					41			**41**
Sutton					17			**17**
Boylston					18			**18**
Northbridge					30			**30**
Oxford						19		**19**
Charlton						18		**18**
Millbury						27		**27**
Auburn						26	28	**54**
Worcester						65	258	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	70							**70**
Total	**1,035**		**793**	**236**	**125**	**155**	**399**	**2,742**
Person Trips by Mode of Access								
Walk	279		0	0	0	0	20	**299**
Kiss'n'Ride	62		63	19	10	12	32	**199**
Park'n'Ride	694		729	217	115	143	347	**2,245**
Parking Spaces								
Demand	**620**		**650**	**190**	**100**	**130**	**310**	**2,000**
Supply	700		420	300	250	300	500	**2,470**

Table 44

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
Remove Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							618
Holliston	32	300						332
Ashland	22	419						441
Southboro		126						126
Hopkinton		150						150
Marlboro	12	126		7				144
Upton		50		50				100
Westboro		21		64				86
Northboro				96				96
Shrewsbury				70	20			90
Grafton					41			41
Sutton					17			17
Boylston					18			18
Northbridge					30			30
Oxford						19		19
Charlton						18		18
Millbury						27		27
Auburn						26	28	54
Worcester						65	258	323
Holden							58	58
Paxton							11	11
Spencer							4	4
Leicester							4	4
W.Boylston							34	34
Other	70							70
Total	**753**	**1,192**		**288**	**125**	**155**	**399**	**2,911**
Person Trips by Mode of Access								
Walk	279	20		0	0	0	20	319
Kiss'n'Ride	45	95		23	10	12	32	218
Park'n'Ride	429	1077		265	115	143	347	2,374
Parking Spaces								
Demand	**380**	**960**		**240**	**100**	**130**	**310**	**2,120**
Supply	700	700		300	250	300	500	2,750

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
Remove Westboro / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	32	300						**332**
Ashland	22	419						**441**
Southboro		21	105					**126**
Hopkinton		45	105					**150**
Marlboro			261					**261**
Upton			126					**126**
Westboro			67		19			**86**
Northboro			61		35			**96**
Shrewsbury			18		72			**90**
Grafton					41			**41**
Sutton					17			**17**
Boylston					18			**18**
Northbridge					30			**30**
Oxford						19		**19**
Charlton						18		**18**
Millbury						27		**27**
Auburn						26	28	**54**
Worcester						65	258	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	**70**							**70**
Total	**742**	**785**	**742**		**230**	**155**	**399**	**3,053**
Person Trips by Mode of Access								
Walk	279	20	0		0	0	20	**319**
Kiss'n'Ride	45	63	59		18	12	32	**229**
Park'n'Ride	418	702	683		211	143	347	**2,504**
Parking Spaces								
Demand	**370**	**630**	**610**		**190**	**130**	**310**	**2,240**
Supply	700	700	420		250	300	500	**2,870**

Table 46

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
Remove Grafton / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	32	300						**332**
Ashland	22	419						**441**
Southboro		21	105					**126**
Hopkinton		45	105					**150**
Marlboro			261					**261**
Upton			99	26				**126**
Westboro			42	44				**86**
Northboro				96				**96**
Shrewsbury				86		4		**90**
Grafton				32		8		**41**
Sutton						17		**17**
Boylston				18				**18**
Northbridge				30				**30**
Oxford						19		**19**
Charlton						18		**18**
Millbury						27		**27**
Auburn						26	28	**54**
Worcester						65	258	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	70							**70**
Total	**742**	**785**	**611**	**332**		**184**	**399**	**3,053**
Person Trips by Mode of Access								
Walk	279	20	0	0		0	20	**319**
Kiss'n'Ride	45	63	49	27		15	32	**229**
Park'n'Ride	418	702	562	305		170	347	**2,504**
Parking Spaces								
Demand	**370**	**630**	**500**	**270**		**150**	**310**	**2,230**
Supply	700	700	420	300		300	500	**2,920**

Table 47

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
Remove Millbury / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	32	300						**332**
Ashland	22	419						**441**
Southboro		21	105					**126**
Hopkinton		45	105					**150**
Marlboro			261					**261**
Upton			99	26				**126**
Westboro			42	44				**86**
Northboro				96				**96**
Shrewsbury				69	21			**90**
Grafton					41			**41**
Sutton					17			**17**
Boylston					18			**18**
Northbridge					30			**30**
Oxford					15		4	**19**
Charlton					13		5	**18**
Millbury					27			**27**
Auburn					33		22	**54**
Worcester					52		271	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	70							**70**
Total	**742**	**785**	**611**	**235**	**266**		**414**	**3,053**
Person Trips by Mode of Access								
Walk	279	20	0	0	0		20	**319**
Kiss'n'Ride	45	63	49	19	21		33	**229**
Park'n'Ride	418	702	562	216	245		361	**2,505**
Parking Spaces								
Demand	**370**	**630**	**500**	**190**	**220**		**320**	**2,230**
Supply	700	700	420	300	250		500	**2,870**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
All Stations Except Regional, Westboro, and Southboro Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin									
Framingham	618								**618**
Holliston	26	306							**332**
Ashland	22	419							**441**
Southboro	23	85							**108**
Hopkinton		134							**134**
Marlboro	14	130							**144**
Upton		58				8			**66**
Westboro		79				7			**86**
Northboro		44				19			**62**
Shrewsbury						87			**87**
Grafton						43			**43**
Sutton						18			**18**
Boylston						19			**19**
Northbridge						32			**32**
Oxford							21		**21**
Charlton							19		**19**
Millbury							29		**29**
Auburn							35	23	**59**
Worcester							70	280	**350**
Holden								62	**62**
Paxton								12	**12**
Spencer								5	**5**
Leicester								5	**5**
W.Boylston								37	**37**
Other	70								**70**
Total	**772**	**1,255**				**233**	**175**	**424**	**2,860**
Person Trips by Mode of Access									
Walk	279	20				0	0	20	**319**
Kiss'n'Ride	46	100				19	14	34	**213**
Park'n'Ride	447	1135				214	161	371	**2,327**
Parking Spaces									
Demand	**400**	**1010**				**190**	**140**	**330**	**2,070**
Supply	700	700				250	300	500	**2,450**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
No Constraint in Southboro
All Stations Except Regional, Westboro, Southboro, & Ashland Stations

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin									
Framingham	618								618
Holliston	174								174
Ashland	233								233
Southboro	102								102
Hopkinton	141								141
Marlboro	24								24
Upton	26					5			31
Westboro	76					9			85
Northboro	81					16			97
Shrewsbury						96			96
Grafton						43			43
Sutton						18			18
Boylston						19			19
Northbridge						32			32
Oxford							21		21
Charlton							19		19
Millbury							29		29
Auburn							35	23	59
Worcester							70	280	350
Holden								62	62
Paxton								12	12
Spencer								5	5
Leicester								5	5
W.Boylston								37	37
Other	70								70
Total	**1,545**					**239**	**175**	**424**	**2,381**
Person Trips by Mode of Access									
Walk	279					0	0	20	299
Kiss'n'Ride	340					19	14	34	407
Park'n'Ride	926					220	161	371	1,677
Parking Spaces									
Demand	**830**					**200**	**140**	**330**	1,500
Supply	700					250	300	500	1,750

Table 50

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
All Stations / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	30	279						**309**
Ashland	20	377						**397**
Southboro		19	95					**114**
Hopkinton		42	97					**139**
Marlboro			239					**239**
Upton			95	25				**120**
Westboro			41	42				**83**
Northboro				90				**90**
Shrewsbury				64	18			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**709**	**717**	**566**	**222**	**115**	**149**	**369**	**2,846**
Person Trips by Mode of Access								
Walk	265	20	0	0	0	0	20	**305**
Kiss'n'Ride	43	57	45	18	9	12	29	**214**
Park'n'Ride	402	640	521	204	106	137	319	**2,328**
Parking Spaces								
Demand	**360**	**570**	**460**	**180**	**90**	**120**	**290**	**2,070**
Supply	600	700	420	300	250	300	500	**3,070**

Table 51

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
Remove Ashland / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	136		34					**170**
Ashland	158		94					**252**
Southboro			114					**114**
Hopkinton	24		115					**139**
Marlboro			239					**239**
Upton			95	25				**120**
Westboro			41	42				**83**
Northboro				90				**90**
Shrewsbury				64	18			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**977**		**731**	**222**	**115**	**149**	**369**	**2,562**
Person Trips by Mode of Access								
Walk	265		0	0	0	0	20	**285**
Kiss'n'Ride	59		58	18	9	12	29	**185**
Park'n'Ride	653		672	204	106	137	319	**2,092**
Parking Spaces								
Demand	**580**		**600**	**180**	**90**	**120**	**290**	**1,860**
Supply	600		420	300	250	300	500	**2,370**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
Remove Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	30	279						**309**
Ashland	20	377						**397**
Southboro		114						**114**
Hopkinton		139						**139**
Marlboro	11	115		7				**132**
Upton		48		48				**96**
Westboro		17		66				**83**
Northboro				90				**90**
Shrewsbury				64	18			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**719**	**1,089**		**276**	**115**	**149**	**369**	**2,715**
Person Trips by Mode of Access								
Walk	265	20		0	0	0	20	**305**
Kiss'n'Ride	43	87		22	9	12	29	**203**
Park'n'Ride	411	982		254	106	137	319	**2,208**
Parking Spaces								
Demand	**370**	**880**		**230**	**90**	**120**	**290**	**1,980**
Supply	600	700		300	250	300	500	**2,650**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
Remove Westboro / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	30	279						**309**
Ashland	20	377						**397**
Southboro		19	95					**114**
Hopkinton		42	97					**139**
Marlboro			239					**239**
Upton			120					**120**
Westboro			65		18			**83**
Northboro			58		33			**90**
Shrewsbury			16		66			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**709**	**717**	**690**		**213**	**149**	**369**	**2,846**
Person Trips by Mode of Access								
Walk	265	20	0		0	0	20	**305**
Kiss'n'Ride	43	57	55		17	12	29	**214**
Park'n'Ride	402	640	635		196	137	319	**2,328**
Parking Spaces								
Demand	**360**	**570**	**570**		**170**	**120**	**290**	**2,080**
Supply	600	700	420		250	300	500	**2,770**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
Remove Grafton / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							597
Holliston	30	279						309
Ashland	20	377						397
Southboro		19	95					114
Hopkinton		42	97					139
Marlboro			239					239
Upton			95	25				120
Westboro			41	42				83
Northboro				90				90
Shrewsbury				79		4		82
Grafton				29		7		37
Sutton						16		16
Boylston				17				17
Northbridge				28				28
Oxford						17		17
Charlton						17		17
Millbury						26		26
Auburn						27	18	44
Worcester						62	247	309
Holden							54	54
Paxton							10	10
Spencer							4	4
Leicester							4	4
W.Boylston							32	32
Other	62							62
Total	**709**	**717**	**566**	**310**		**175**	**369**	**2,846**
Person Trips by Mode of Access								
Walk	265	20	0	0		0	20	305
Kiss'n'Ride	43	57	45	25		14	29	214
Park'n'Ride	402	640	521	285		161	319	2,328
Parking Spaces								
Demand	**360**	**570**	**460**	**250**		**140**	**290**	**2,070**
Supply	600	700	420	300		300	500	**2,820**

Table 55

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
Remove Millbury / No Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	30	279						**309**
Ashland	20	377						**397**
Southboro		19	95					**114**
Hopkinton		42	97					**139**
Marlboro			239					**239**
Upton			95	25				**120**
Westboro			41	42				**83**
Northboro				90				**90**
Shrewsbury				63	19			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford					14		3	**17**
Charlton					13		3	**17**
Millbury					26			**26**
Auburn					27		18	**44**
Worcester					52		257	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**709**	**717**	**566**	**221**	**248**		**385**	**2,846**
Person Trips by Mode of Access								
Walk	265	20	0	0	0		20	**305**
Kiss'n'Ride	43	57	45	18	20		31	**214**
Park'n'Ride	402	640	521	204	228		334	**2,328**
Parking Spaces								
Demand	**360**	**570**	**460**	**180**	**200**		**300**	**2,070**
Supply	600	700	420	300	250		500	**2,770**

Table 56

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
All Stations Except Regional, Westboro, and Southboro Station

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin									
Framingham	597								**597**
Holliston	24	285							**309**
Ashland	20	377							**397**
Southboro	20	77							**97**
Hopkinton		125							**125**
Marlboro	13	119							**132**
Upton		56				8			**64**
Westboro		76				7			**83**
Northboro		41				18			**59**
Shrewsbury						80			**80**
Grafton						39			**39**
Sutton						17			**17**
Boylston						18			**18**
Northbridge						30			**30**
Oxford							19		**19**
Charlton							18		**18**
Millbury							28		**28**
Auburn							29	19	**48**
Worcester							67	268	**334**
Holden								58	**58**
Paxton								11	**11**
Spencer								4	**4**
Leicester								5	**5**
W.Boylston								35	**35**
Other	62								**62**
Total	**736**	**1,156**				**215**	**160**	**399**	**2,667**
Person Trips by Mode of Access									
Walk	265	20				0	0	20	**305**
Kiss'n'Ride	44	92				17	13	32	**199**
Park'n'Ride	427	1043				198	148	347	**2,163**
Parking Spaces									
Demand	**380**	**930**				**180**	**130**	**310**	**1,930**
Supply	600	700				250	300	500	**2,350**

Table 57

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
No Constraint in Southboro
All Stations Except Regional, Westboro, Southboro, & Ashland Stations

	Framingham Station	Ashland Station	Southboro Station	Regional Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin									
Framingham	597								**597**
Holliston	168								**168**
Ashland	186								**186**
Southboro	81								**81**
Hopkinton	103								**103**
Marlboro	16								**16**
Upton	22					4			**26**
Westboro	63					7			**70**
Northboro	65					13			**78**
Shrewsbury						88			**88**
Grafton						39			**39**
Sutton						17			**17**
Boylston						18			**18**
Northbridge						30			**30**
Oxford							19		**19**
Charlton							18		**18**
Millbury							28		**28**
Auburn							29	19	**48**
Worcester							67	268	**334**
Holden								58	**58**
Paxton								11	**11**
Spencer								4	**4**
Leicester								5	**5**
W.Boylston								35	**35**
Other	62								**62**
Total	**1,363**					**216**	**160**	**399**	**2,137**
Person Trips by Mode of Access									
Walk	265					0	0	20	**285**
Kiss'n'Ride	330					17	13	32	**392**
Park'n'Ride	768					199	148	347	**1,462**
Parking Spaces									
Demand	**690**					**180**	**130**	**310**	**1,310**
Supply	600					250	300	500	**1,650**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
All Stations / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							734
Holliston	37	345						382
Ashland	28	523						551
Southboro		59	97					156
Hopkinton		93	73					166
Marlboro		65	194					259
Upton			105	28				133
Westboro			47	45				92
Northboro				109				109
Shrewsbury				83	24			107
Grafton					50			50
Sutton					20			20
Boylston					20			20
Northbridge					35			35
Oxford						23		23
Charlton						20		20
Millbury						30		30
Auburn						51	34	85
Worcester						71	284	355
Holden							67	67
Paxton							13	13
Spencer							5	5
Leicester							5	5
W.Boylston							40	40
Other	82							82
Total	**881**	**1,085**	**516**	**265**	**149**	**195**	**448**	**3,539**
Person Trips by Mode of Access								
Walk	294	20	0	0	0	0	20	334
Kiss'n'Ride	53	87	41	21	12	16	36	265
Park'n'Ride	534	978	475	244	137	179	392	2,939
Parking Spaces								
Demand	**480**	**870**	**420**	**220**	**120**	**160**	**350**	**2,620**
Supply	700	700	420	300	250	300	500	3,170

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
Remove Ashland / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							734
Holliston	167		3					170
Ashland	270		30					300
Southboro	42		109					151
Hopkinton	37		95					132
Marlboro	57		182					239
Upton	6		56	45				107
Westboro			40	42				82
Northboro				109				109
Shrewsbury				83	24			107
Grafton					50			50
Sutton					20			20
Boylston					20			20
Northbridge					35			35
Oxford						23		23
Charlton						20		20
Millbury						30		30
Auburn						51	34	85
Worcester						71	284	355
Holden							67	67
Paxton							13	13
Spencer							5	5
Leicester							5	5
W.Boylston							40	40
Other	82							82
Total	**1,396**		**515**	**279**	**149**	**195**	**448**	**2,981**
Person Trips by Mode of Access								
Walk	294		0	0	0	0	20	314
Kiss'n'Ride	84		41	22	12	16	36	211
Park'n'Ride	1018		473	257	137	179	392	2,456
Parking Spaces								
Demand	**910**		**420**	**230**	**120**	**160**	**350**	2,190
Supply	700		420	300	250	300	500	2,470

Table 60

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2011
Remove Westboro / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	734							**734**
Holliston	37	345						**382**
Ashland	28	523						**551**
Southboro		94	62					**156**
Hopkinton		115	49					**164**
Marlboro		130	159					**289**
Upton			97		41			**138**
Westboro			69		23			**92**
Northboro			63		46			**109**
Shrewsbury			11		96			**107**
Grafton					50			**50**
Sutton					20			**20**
Boylston					20			**20**
Northbridge					35			**35**
Oxford						23		**23**
Charlton						20		**20**
Millbury						30		**30**
Auburn						51	34	**85**
Worcester						71	284	**355**
Holden							67	**67**
Paxton							13	**13**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							40	**40**
Other	82							**82**
Total	**881**	**1,207**	**510**		**331**	**195**	**448**	**3,572**
Person Trips by Mode of Access								
Walk	294	20	0		0	0	20	**334**
Kiss'n'Ride	53	97	41		27	16	36	**268**
Park'n'Ride	534	1090	469		305	179	392	**2,970**
Parking Spaces								
Demand	**480**	**970**	**420**		**270**	**160**	**350**	**2,650**
Supply	700	700	420		250	300	500	**2,870**

Table 61

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
All Stations / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							681
Holliston	34	321						355
Ashland	25	471						496
Southboro		42	98					140
Hopkinton		78	75					153
Marlboro		61	193					254
Upton			104	28				131
Westboro			43	45				88
Northboro				102				102
Shrewsbury				77	22			98
Grafton					45			45
Sutton					18			18
Boylston					19			19
Northbridge					32			32
Oxford						21		21
Charlton						19		19
Millbury						29		29
Auburn						41	27	68
Worcester						68	273	341
Holden							62	62
Paxton							12	12
Spencer							5	5
Leicester							5	5
W.Boylston							37	37
Other	74							74
Total	**814**	**973**	**513**	**252**	**136**	**177**	**421**	**3,286**
Person Trips by Mode of Access								
Walk	287	20	0	0	0	0	20	327
Kiss'n'Ride	49	78	41	20	11	14	34	247
Park'n'Ride	478	875	472	232	125	163	367	2,712
Parking Spaces								
Demand	**430**	**780**	**420**	**210**	**110**	**150**	**330**	**2,430**
Supply	700	700	420	300	250	300	500	3,170

Table 62

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
Remove Ashland / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	167		5					**172**
Ashland	252		31					**284**
Southboro	38		102					**140**
Hopkinton	40		94					**134**
Marlboro	47		189					**236**
Upton	4		55	43				**102**
Westboro			39	40				**79**
Northboro				102				**102**
Shrewsbury				77	22			**98**
Grafton					45			**45**
Sutton					18			**18**
Boylston					19			**19**
Northbridge					32			**32**
Oxford						21		**21**
Charlton						19		**19**
Millbury						29		**29**
Auburn						41	27	**68**
Worcester						68	273	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**1,304**		**515**	**262**	**136**	**177**	**421**	**2,815**
Person Trips by Mode of Access								
Walk	287		0	0	0	0	20	**307**
Kiss'n'Ride	78		41	21	11	14	34	**199**
Park'n'Ride	938		473	241	125	163	367	**2,308**
Parking Spaces								
Demand	**840**		**420**	**220**	**110**	**150**	**330**	**2,070**
Supply	700		420	300	250	300	500	**2,470**

Table 63

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2006
Remove Westboro / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	681							**681**
Holliston	34	321						**355**
Ashland	25	471						**496**
Southboro		67	73					**140**
Hopkinton		84	69					**153**
Marlboro		118	145					**263**
Upton			92		39			**131**
Westboro			59		20			**79**
Northboro			59		43			**102**
Shrewsbury			10		89			**98**
Grafton					45			**45**
Sutton					18			**18**
Boylston					19			**19**
Northbridge					32			**32**
Oxford						21		**21**
Charlton						19		**19**
Millbury						29		**29**
Auburn						41	27	**68**
Worcester						68	273	**341**
Holden							62	**62**
Paxton							12	**12**
Spencer							5	**5**
Leicester							5	**5**
W.Boylston							37	**37**
Other	74							**74**
Total	**815**	**1,061**	**506**		**305**	**177**	**421**	**3,286**
Person Trips by Mode of Access								
Walk	287	20	0		0	0	20	**327**
Kiss'n'Ride	49	85	41		24	14	34	**247**
Park'n'Ride	479	956	466		281	163	367	**2,712**
Parking Spaces								
Demand	**430**	**850**	**420**		**250**	**150**	**330**	**2,430**
Supply	700	700	420		250	300	500	**2,870**

Table 64

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
All Stations / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	32	300						**332**
Ashland	22	419						**441**
Southboro		38	88					**126**
Hopkinton		63	78					**141**
Marlboro		36	204					**240**
Upton			99	26				**126**
Westboro			42	44				**86**
Northboro				96				**96**
Shrewsbury				70	20			**90**
Grafton					41			**41**
Sutton					17			**17**
Boylston					18			**18**
Northbridge					30			**30**
Oxford						19		**19**
Charlton						18		**18**
Millbury						27		**27**
Auburn						33	22	**54**
Worcester						65	258	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	70							**70**
Total	**742**	**856**	**511**	**236**	**125**	**162**	**392**	**3,024**
Person Trips by Mode of Access								
Walk	279	20	0	0	0	0	20	**319**
Kiss'n'Ride	45	68	41	19	10	13	31	**227**
Park'n'Ride	419	768	470	217	115	149	341	**2,478**
Parking Spaces								
Demand	**370**	**690**	**420**	**190**	**100**	**130**	**300**	**2,200**
Supply	700	700	420	300	250	300	500	**3,170**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
Remove Ashland / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	153		3					**157**
Ashland	212		32					**244**
Southboro	28		90					**118**
Hopkinton	36		96					**132**
Marlboro	33		190					**223**
Upton			62	45				**106**
Westboro			42	44				**86**
Northboro				96				**96**
Shrewsbury				70	20			**90**
Grafton					41			**41**
Sutton					17			**17**
Boylston					18			**18**
Northbridge					30			**30**
Oxford						19		**19**
Charlton						18		**18**
Millbury						27		**27**
Auburn						33	22	**54**
Worcester						65	258	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	70							**70**
Total	**1,151**		**515**	**254**	**125**	**162**	**392**	**2,598**
Person Trips by Mode of Access								
Walk	279		0	0	0	0	20	**299**
Kiss'n'Ride	69		41	20	10	13	31	**185**
Park'n'Ride	803		473	234	115	149	341	**2,114**
Parking Spaces								
Demand	**720**		**420**	**210**	**100**	**130**	**300**	**1,880**
Supply	700		420	300	250	300	500	**2,470**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 2001
Remove Westboro / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	618							**618**
Holliston	32	300						**332**
Ashland	22	419						**441**
Southboro		61	66					**126**
Hopkinton		78	72					**150**
Marlboro		77	163					**240**
Upton			88		38			**126**
Westboro			53		23			**76**
Northboro			58		38			**96**
Shrewsbury			9		81			**90**
Grafton					41			**41**
Sutton					17			**17**
Boylston					18			**18**
Northbridge					30			**30**
Oxford						19		**19**
Charlton						18		**18**
Millbury						27		**27**
Auburn						33	22	**54**
Worcester						65	258	**323**
Holden							58	**58**
Paxton							11	**11**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							34	**34**
Other	70							**70**
Total	**742**	**934**	**508**		**285**	**162**	**392**	**3,023**
Person Trips by Mode of Access								
Walk	279	20	0		0	0	20	**319**
Kiss'n'Ride	45	75	41		23	13	31	**227**
Park'n'Ride	418	839	468		262	149	341	**2,476**
Parking Spaces								
Demand	**370**	**750**	**420**		**230**	**130**	**300**	**2,200**
Supply	700	700	420		250	300	500	**2,870**

Table 67

Worcester Rail Extension II

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
All Stations / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	30	279						**309**
Ashland	20	377						**397**
Southboro		23	91					**114**
Hopkinton		56	84					**139**
Marlboro		35	196					**231**
Upton			95	25				**120**
Westboro			41	42				**83**
Northboro				90				**90**
Shrewsbury				64	18			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	**62**							**62**
Total	**709**	**769**	**506**	**222**	**115**	**149**	**369**	**2,838**
Person Trips by Mode of Access								
Walk	265	20	0	0	0	0	20	**305**
Kiss'n'Ride	43	62	41	18	9	12	29	**213**
Park'n'Ride	402	688	466	204	106	137	319	**2,321**
Parking Spaces								
Demand	**360**	**610**	**420**	**180**	**90**	**120**	**290**	**2,070**
Supply	600	700	420	300	250	300	500	**3,070**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
Remove Ashland / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	147		3					**150**
Ashland	209		31					**240**
Southboro	20		89					**110**
Hopkinton	37		98					**134**
Marlboro	33		187					**220**
Upton			66	44				**110**
Westboro			41	42				**83**
Northboro				90				**90**
Shrewsbury				64	18			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**1,104**		**514**	**241**	**115**	**149**	**369**	**2,491**
Person Trips by Mode of Access								
Walk	265		0	0	0	0	20	**285**
Kiss'n'Ride	66		41	19	9	12	29	**177**
Park'n'Ride	772		473	222	106	137	319	**2,029**
Parking Spaces								
Demand	**690**		**420**	**200**	**90**	**120**	**290**	**1,810**
Supply	600		420	300	250	300	500	**2,370**

Estimated Daily Inbound Commuter Rail Trips to Boston CBD
and East Cambridge, Year 1996
Remove Westboro / With Constraint in Southboro
No Regional Station

	Framingham Station	Ashland Station	Southboro Station	Westboro Station	Grafton Station	Millbury Station	Worcester Station	All Stations
Person Trips by Town of Origin								
Framingham	597							**597**
Holliston	30	279						**309**
Ashland	20	377						**397**
Southboro		40	74					**114**
Hopkinton		92	39					**131**
Marlboro		66	154					**220**
Upton			84		36			**120**
Westboro			70		12			**83**
Northboro			74		16			**90**
Shrewsbury			12		70			**82**
Grafton					37			**37**
Sutton					16			**16**
Boylston					17			**17**
Northbridge					28			**28**
Oxford						17		**17**
Charlton						17		**17**
Millbury						26		**26**
Auburn						27	18	**44**
Worcester						62	247	**309**
Holden							54	**54**
Paxton							10	**10**
Spencer							4	**4**
Leicester							4	**4**
W.Boylston							32	**32**
Other	62							**62**
Total	**708**	**854**	**508**		**231**	**149**	**369**	**2,819**
Person Trips by Mode of Access								
Walk	265	20	0		0	0	20	**305**
Kiss'n'Ride	43	68	41		19	12	29	**211**
Park'n'Ride	401	765	467		213	137	319	**2,302**
Parking Spaces								
Demand	**360**	**680**	**420**		**190**	**120**	**290**	**2,060**
Supply	600	700	420		250	300	500	**2,770**

WORCESTER COMMUTER RAIL EXTENSION STUDY UPDATE

CTPS TRAVEL DEMAND FORECASTING PROCEDURES

1.0 Introduction

This appendix contains a detailed description of the travel demand forecasting procedures used to estimate the rail ridership for the proposed Worcester Commuter Rail Extension project. These procedures are very similar to those used in the 1990 Feasibility Study. In fact, in the current analysis, we used the results of a few sub-models and analysis procedures used in the original 1990 Feasibility Study.

Our travel forecasts were produced using a state-of-the-practice set of urban travel demand models. This set of models has been used at CTPS for many transit forecasting projects during the last several years.

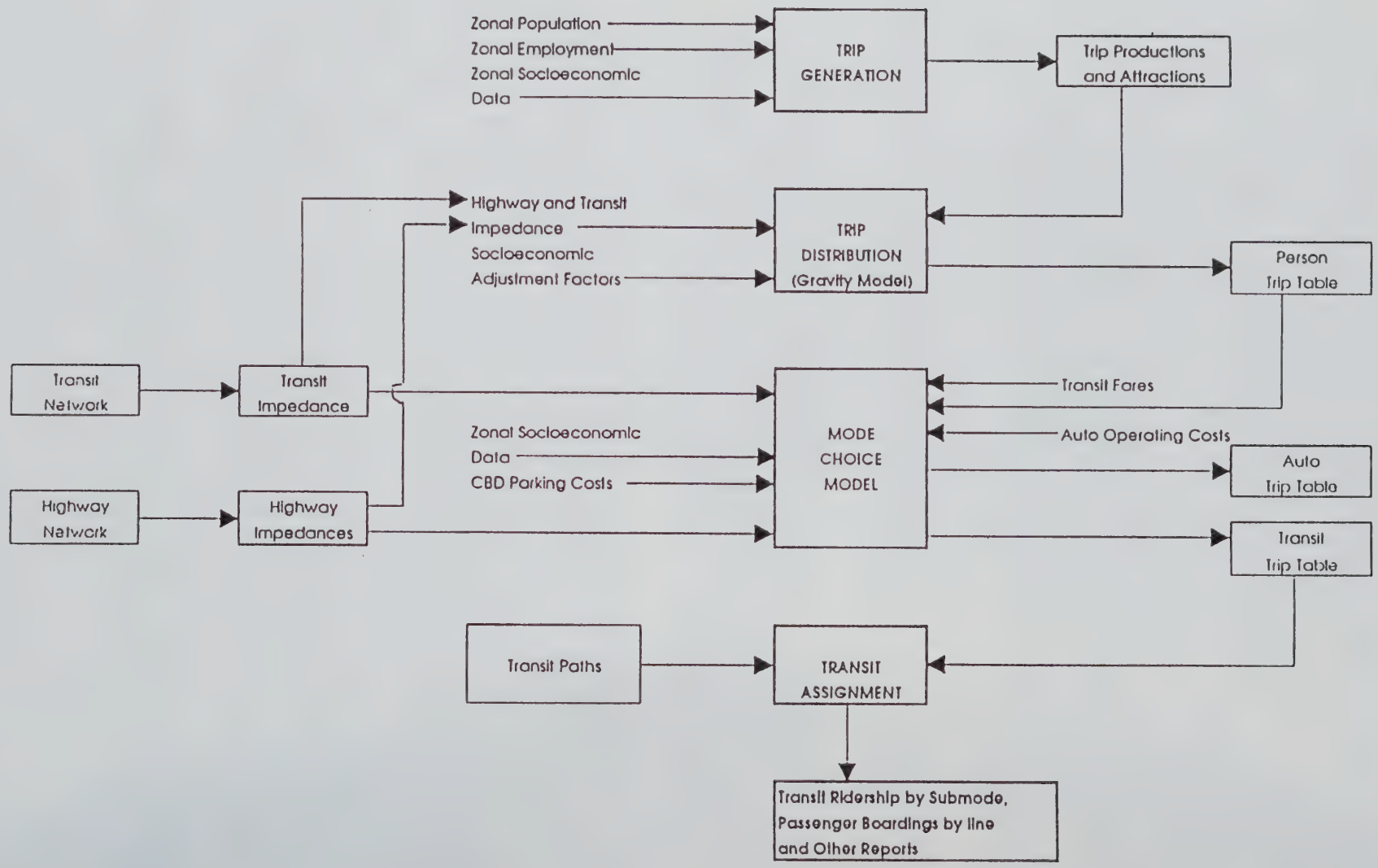
The model set simulates travel on the entire Eastern Massachusetts transit and highway system. As such, it contains all MBTA rail and bus lines and all private express bus lines. The model contains service frequency(i.e. how often trains and buses arrive at any given transit stop), routing, travel time and fares for all these lines. In the highway system, all express highways and principal arterial roadways and many minor arterial and local roadways are included.

The travel demand forecasting procedure used in this analysis is based on the traditional four-step, sequential process comprising trip generation, trip distribution, mode choice and trip assignment. This process is used to estimate average daily transit ridership, primarily on the basis of forecasts of population and employment, projected highway travel conditions (including downtown parking costs) and projected transit service to be provided. The actual structure of the travel demand forecasting process used in this study followed a somewhat simplified version of the traditional four step sequential urban transportation planning process.

The entire geographic area represented in our model, the Eastern Massachusetts, is divided into several hundred smaller areas known as **traffic zones**. Our model set employs sophisticated and involved techniques in each step of the process. The following paragraphs describe very briefly what each step does. Figure 1 shows the major inputs and outputs involved in the four step modeling process.

Trip Generation: In this step, the model estimates how many trips are generated in each traffic zone using estimates of projected population and employment and other socioeconomic characteristics of that zone.

FIGURE 1: THE FOUR STEP TRAVEL DEMAND MODELING PROCESS



Trip Distribution: In this step, the model takes the total trips generated by each zone and distributes them to all the other zones in the study area based on a Newtonian principle of relative attractiveness. This creates a trip flow pattern.

Mode Choice: After the trip flow pattern is determined, the model estimates what proportion of the trip flow is by automobile and by transit mode. It uses the relative travel times and costs by automobile and transit to estimate these proportions.

Trip Assignment: In this final step, the model assigns the transit trips to different transit modes such as Subway, Commuter Rail, Local Bus, Express Bus, etc. To do this, it uses the shortest transit path from one zone to another. This path may involve just one mode such as a local bus or multiple modes such as a local bus and a transfer to the subway line, etc. The automobile trips are assigned to the highway network and the resulting traffic volumes on all highway links are summarized.

Because the proposed rail service in this study would serve an area outside of the standard Central Transportation Planning Staff (CTPS) study region for which trip tables were already developed and available, the trip generation and distribution steps were carried out somewhat differently than for other studies in the past. This involved using information from the Central Artery/Third Harbor Tunnel Project and from a past study of commuting patterns in the greater Boston area. Existing CTPS highway networks were expanded to include the Worcester area. This network development was accomplished in the MINUTP microcomputer modelling system, as was the production of highway travel times and distances (skims) from these networks. The highway times and distances were transferred to the mainframe computer for use with the existing CTPS model set which includes the mode choice model and the assignment process.

Section 2 discusses the establishment of the market area for the proposed transit service. The method used to develop current and future year travel demand between this market area and the Boston CBD employment center is described in detail in section 3. Section 4 contains the details of the transit and highway networks used in the Worcester analysis, while sections 5 and 6 cover the development of inputs to the mode choice model and details of the mode choice model itself. Finally, section 7 describes the assignment step of the modelling procedure.

2.0 Defining the Worcester Market Area

This section describes what the market area for riders on the proposed rail service to Worcester is and how it was defined. As a part of this description, there is a brief discussion of the current market conditions, how they came about and how they are expected to evolve in the future.

2.1 Factors Defining a Market Area for New Rail Service

Several factors help determine the extent of the market area for a new commuter rail service. The majority of commuter rail trips are work trips. It follows that in defining a market area for proposed new commuter rail service, it is important to look first at how accessible the area currently is to the employment centers to which it will be connected by the new rail service. In the case of the proposed Worcester rail extension, those employment centers are Boston CBD and to a lesser extent Cambridge. The level of accessibility is usually related to how strongly oriented the market area is to Boston, and the strength of that orientation is another important factor in determining the size of the market. It is also necessary to consider existing transit services. Their locations may highlight areas which may be "underserved" by transit and provide boundaries for the potential market area for new service. The market size is also a function of the locations of proposed rail stations and the ease of access to those stations from surrounding communities.

2.2 Defining the Worcester Market Area

The Boston CBD is an important employment center for residents of the I-90/I-495 area and Central Massachusetts. Trends in housing costs and labor availability during the 1980s have strengthened what in 1980 was already a strong economic relationship between Boston and this region. Continuation of these trends into the future combined with worsening auto commute travel times into Boston suggest that the market for rail service from Central Massachusetts and the I-90/I-495 region to Boston can be expected to grow.

The Worcester corridor is well connected by highway facilities to Boston. The Massachusetts Turnpike is the most important of these. Also very important are Route 9 and to a lesser extent Route 20. Interstate 495 serves as a feeder to these east-west routes from communities such as Marlborough and Hopkinton.

Boston employment rose by approximately 50,000 between 1980 and 1987. Given its accessibility to Boston, it is not surprising that during the 1980s the number of people living in the I-90/I-495 area and Central Massachusetts and working in Boston has increased significantly. Another factor leading to this increase is that of housing costs. In the 1980 s, the Boston area real estate market experienced dramatic increases in housing costs and the rental market had extremely low vacancy rates. The average housing unit cost in Boston itself rose from $63,000 in 1980 to $178,000 in 1988, or 182%. In a suburb such as Needham, the increase was from $84,000 to $235,000, or 180%. In Worcester, the average housing unit cost went from $37,000 in 1980 to $117,000 in 1988, a 216% increase; many other communities at considerable distance from Boston experienced similar changes ("The Demographics of Commuting in Greater Boston", a CTPS Report as a portion of the Transportation Plan for the Boston MPO Region, October, 1989) . As employment in Downtown Boston expanded, a significant number of new employees were forced to live further away where more affordable housing was

available and to commute from longer distances to work than in 1980. Because the cities and towns in the I-90/I-495 area and Central Massachusetts are well connected via highways to Boston, they experienced significant growth in the number of residents working in Downtown Boston. The "push" factors of good highway connections and lower housing costs were accentuated by the fact that while employment growth was booming in the Boston area, employment growth in most of Central Massachusetts was relatively slow and unemployment rates were higher. In some labor market sectors, the labor pool in the immediate Boston area was exhausted and employers had to draw from further away. Central Massachusetts and the I-90/I-495 region, with their accessibility to Boston, availability of affordable housing and labor supply, grew significantly as a source of Downtown Boston employees during the 1980s.

Current projections of employment growth in downtown Boston along with continued lower unemployment rates and higher housing costs in comparison to the Central Massachusettsand I-90/I-495 region suggest that more people will be working downtown but commuting from further away. Meanwhile current traffic conditions on Route 9 and the Massachusetts Turnpike are rapidly becoming more congested. Projected traffic conditions show that auto commuting times to downtown Boston will be significantly longer than at present by the year 2011. This suggests that the towns and cities in the market area for the proposed rail service will constitute a significantly larger potential Downtown Boston-oriented rail market by the year 2011 than they do now.

2.3 Market Area Boundaries and Communities

In addition to the degree of Boston orientation and general accessibility, another important factor which helps to geographically define the market area for new Worcester rail service is that of existing transit service and service assumed to exist in the horizon year for the project, 2011. The current Fitchburg Line, with station stops in Littleton, Acton and Concord, defines the northern edge of the market area. The Franklin Line, with its extension to Bellingham and Milford, defines the southern edge of the market area. The eastern boundary is defined by the service to Boston which exists from Framingham. Surveys of rail service in the Boston area have shown that people are willing to travel a limited distance to reach a rail station. This information combined with 1980 and 1990 Journey-to-Work information, which shows that there were few work trips to Boston from communities further west than Spencer, helped to determine the western boundary of the market area.

The market area is perhaps most obviously determined by the locations of the proposed rail stations. Surveys of existing commuter rail service have shown that the market for a station is usually largest in the town where the station is located. While this may be partially attributed to the fact that rail stations are often located in the larger population centers of a given market area, it is also true that people are usually only willing to travel a few miles (with some exceptions, particularly line terminus stations) to reach a rail station. The following communities have rail stations located within them in the proposed rail service.

Framingham
Ashland
Southborough
Westborough
Grafton
Millbury
Worcester

In addition to these communities are the cities and towns from which potential riders can easily reach the rail stations. The following communities are within reasonable reach of the above cities and towns and are more accessible to the proposed stations than they are to any stations assumed to exist on other rail lines in 2011:

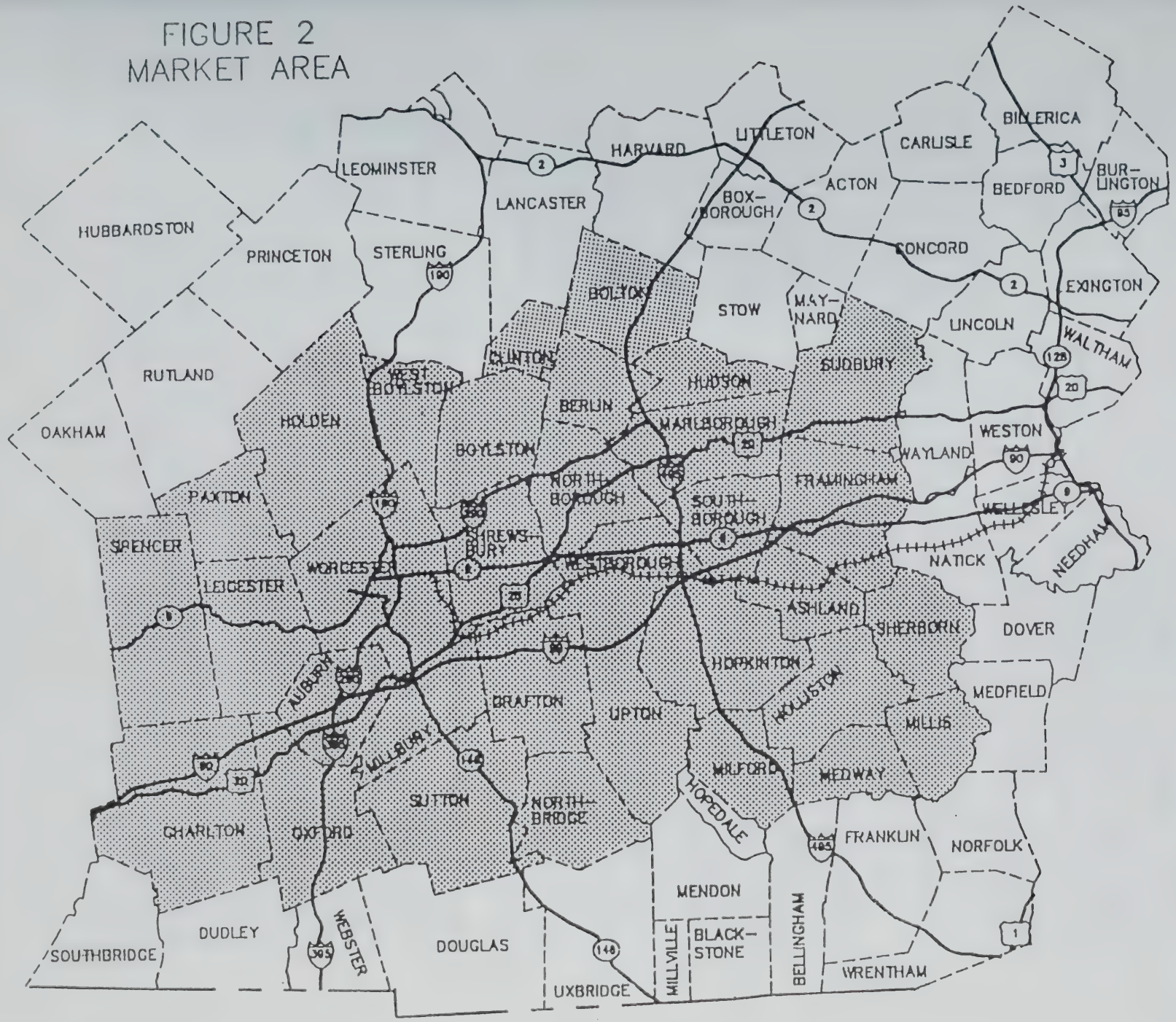
Holliston
Hopkinton
Marlborough
Milford
Upton
Hudson
Berlin
Bolton
Clinton
Northborough
Shrewsbury
Sutton
Boylston
Northbridge
Oxford
Charlton
Auburn
Holden
Paxton
Spencer
Leister
West Boylston

These communities are shown in Figure 2

2.4 Market Area Work Trips to Boston

Once the market area is defined geographically, it must be defined in terms of potential users of the proposed rail service. Recent surveys of Boston area rail lines have shown that approximately 90% of commuter rail trips are work trips and a large portion of these

FIGURE 2
MARKET AREA



are to jobs in Boston. While there are many people who both live and work within the market area, it is unlikely that a significant proportion of them would be served by radial, Boston-oriented rail service. There probably are some people who, for example, live in Worcester and work in Framingham and could conceivably use the train to travel to and from work. However, few of them would likely be willing to drive or take a bus to the Worcester station, wait for the train, ride it to Framingham, then wait for a bus or other transportation to their places of employment when they can drive from home to work in what is probably less total time. People who work in the market area can also, in most cases, park at work without much added cost or time. Traffic congestion between cities and towns in the market area is reasonable compared to congestion approaching Boston, and parking is much cheaper and more readily available than in Boston.

For these reasons the modeling procedure used to forecast rail ridership in this study was concerned primarily with work trips from the market area to Boston.

3.0 Estimation of Total Person Trips (Market Analysis)

Once the geographical market area for the proposed new rail service to Worcester was defined, it was necessary to produce a 2011 trip table. This trip table contained work trips from this market area to the Boston CBD and East Cambridge. Next to Boston CBD, east Cambridge is the biggest employer in the metropolitan Boston area and therefore was included as a destination area for the demand analysis.

As explained above, the market for the new rail service is composed primarily of work trips to the CBD as opposed to non-work trips or work trips contained entirely within the defined market area. The process of producing the work trip table incorporated the trip generation and trip distribution steps of the modelling process. As opposed to generating and distributing trips with models, however, it relied on existing trip information and socioeconomic data.

The majority of the Worcester Commuter Rail Extension study area is outside of the normal CTPS regional study area, and as a result the existing CTPS regional person trip tables developed as part of recent transit planning studies could not be used for this analysis. Consequently, the existing and year 2011 work trips from all of the cities and towns in the study corridor to the downtown Boston and Cambridge area were developed based on 1990 Census Journey-to-Work data, socioeconomic information for the cities and towns, and work trip attraction control totals for the downtown Boston area which were developed as part of the Central Artery/Third Harbor Tunnel (CA/THT) Project. The first step in this process was the tabulation of 1990 Census Journey-to-Work trips destined to Boston and Cambridge via private motorized vehicle and public transportation for each of the cities and towns in the study area. These work trips to Boston and Cambridge were then factored to 2011 based on percentage change in population for each city and town between 1990 and 2011. These percentages were taken directly from the original 1990 Feasibility Study. A factor of 0.90 was then applied to these work trips to

convert them to typical weekday estimates, accounting for employee vacation and sick time. The resulting work trips were further factored up to account for non-work related trips destined to Boston CBD and Cambridge. This factoring was done on the basis of information obtained from the 1990 Census data for each town and city within the study corridor and also from the system-wide 1993 CTPS commuter rail survey. Figure 3 shows the process used in developing the 2011 person trip table.

The final 1990 work trips and the estimated 2011 work trips from each city and town in the Worcester Commuter Rail Extension study area are presented in Table 1A.

4.0 Network Building

Network building is one of the most involved and time consuming steps in the travel demand forecasting process. The procedure entails translating written descriptions of transportation services into computer processable code. The resulting networks are used, in conjunction with trip tables, to simulate travel in the travel assignment process described later. In addition, they are used to generate matrices of data for use in the mode choice stage, also described later. Two sets of highway and transit networks were built for this study. One set represented 1988 and was used in validating the model set, while the other represented 2011 and was used to produce the transit patronage forecasts.

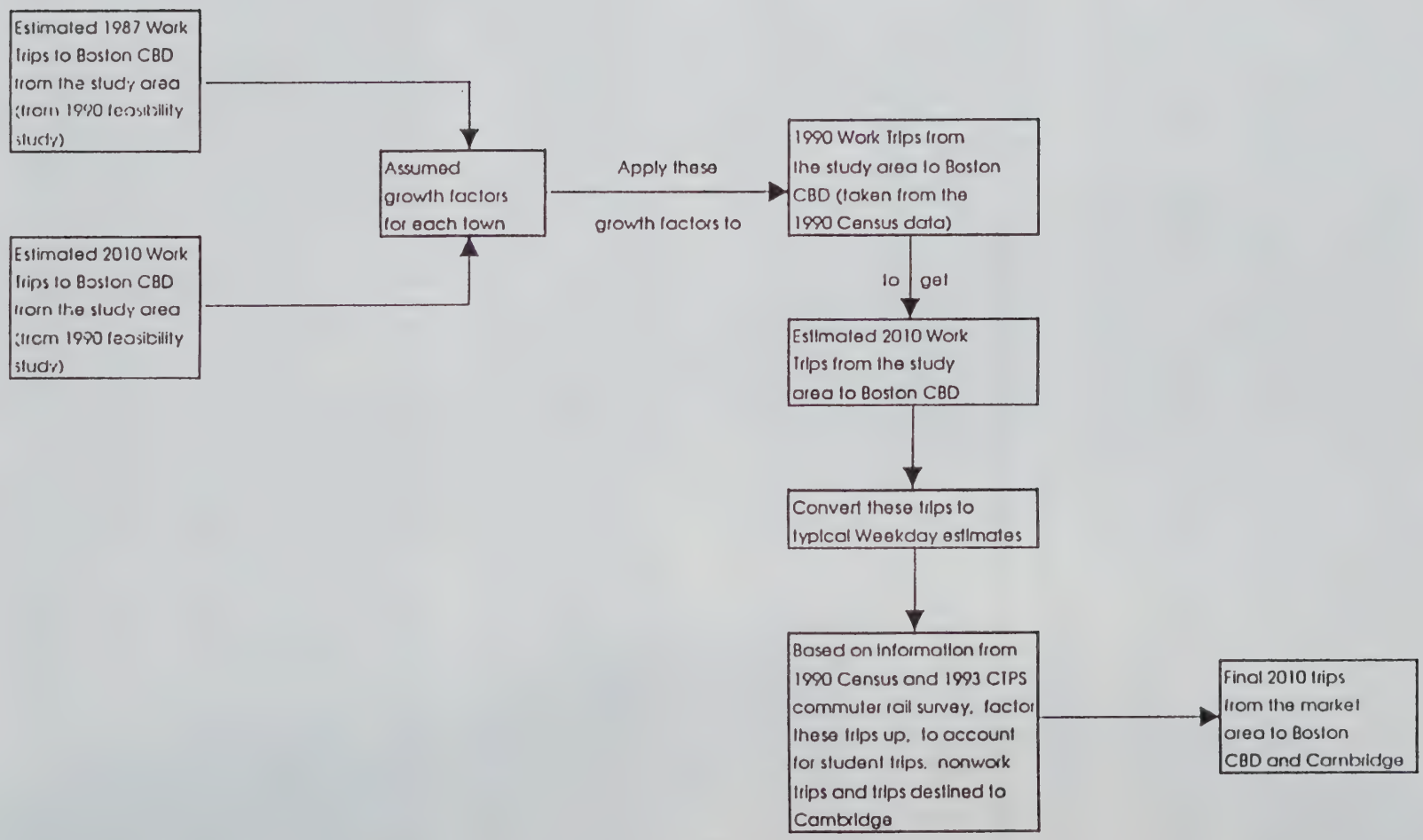
4.1 Transit Networks

Transit networks for this study were built with the UTPS INET program by adding the services of interest to an existing regional transit network developed at CTPS for use in several recent MBTA studies. The service of interest is, of course, the commuter rail extension from Framingham to Worcester. The rail line is composed of a series of links, connecting stations or stops, each link having time, distance and travel speed coded on it. Travel times for rail lines were obtained from the consultant team.

Of critical importance was the way in which access to the lines of interest was coded. These access connections largely control the level of boardings simulated at stations. Each station or stop, if in a populated area, was connected to the traffic zone system by a walk access link coded at 2.5 miles-per-hour. In addition, each was connected to one or more zones by drive access links coded with speeds representing actual automobile travel speeds in those particular areas. In general, drive access links were provided only to zones within six miles of a station, consistent with findings on travel behavior gleaned from recent transit passenger surveys.

In addition to the services of interest in this study, other "background" services - those assumed to exist in the future -were coded into the 2011 transit network. These include shuttle bus services between downtown Boston and the South Boston Piers area, North and South Station transportation centers, a Bowdoin-Charles connector, and extended rail

FIGURE 3: Development of 2010 Person Trip Table



service to Newburyport. These services have little or no effect on the line extension analyzed in this study, but were included for consistency with other studies.

4.2 Highway Networks

Present and future highway networks were built for this study in the microcomputer-based MINUTP travel analysis package. Such networks were necessary in order to generate future year estimates of auto travel times. These, as noted, were used in the mode choice model and to estimate future year rail ridership.

The existing CTPS regional highway network served as the basis for that used in this study. However, since it did not extend far enough west, a new network was developed for the study area itself. This network was coded into MINUTP and combined with the CTPS regional network, resulting in one continuous highway network from the Worcester study area to downtown Boston. The 2011 network includes the Central Artery/Third Harbor Tunnel.

5.0 Path Building and Skimming

5.1 Transit

This refers to the process of using the computer to find the most sensible -- usually defined as the quickest -- travel path between one place and another using the networks built as described above. The computer programs that build the transit paths, account for each component of the time required to make a trip by transit between every pair of zones. These components include time spent walking or driving to the transit line, waiting for the transit vehicle, riding on the line, transferring to another line, if necessary, and walking to a final destination.

Once the paths are built, the times and distances on them are skimmed by the computer, or summarized, in the form of matrices. These matrices are then saved for use in the mode choice model. The paths themselves are saved to use in the travel assignment process, described later. This process is applied both to the transit and highway networks. The procedures followed here are part of the standard urban travel demand forecasting method recognized by FTA.

5.2 Highway

Highway paths were built and skimmed solely to obtain matrices of highway travel times and distances for use in the mode choice model. The times were calculated to reflect the effects of traffic congestion. In order to do so, a highway vehicle trip table is usually required. However, as none was available for the study area itself, a different approach was used.

Traffic counts were obtained from the Central Massachusetts Regional Planning Commission and entered into the 1988 MINUTP-based highway network that was built as described above. Since counts did not exist for all the links in the network, they were estimated by imputing values from actual counts on nearby links. The MINUTP highway pathbuilding program, then, used these counts, in place of the usual assigned volumes produced from a trip table to derive minimum time paths on the study area portion of the network. In the CTPS regional highway portion of the network to the east, congested times and minimum time paths were based, in the usual manner, on a 1988 vehicle trip table assignment. The path skimming program was then applied to the paths connecting the study area with downtown Boston to produce matrices of distance and congested time which were then transferred to the mainframe computer for use in the mode choice model.

This process was followed in order to validate, or ensure the accuracy, of the 1988-based model set. After validation, the traffic counts in the study area were factored up to 2011 based on historical growth rates and changes in area population and employment. Within the CTPS regional highway network, an existing 2011 regional vehicle trip table was assigned and the pathbuilder and pathskimmer applied in order to yield complete study area-to-Boston highway skims. These were transferred to the mainframe computer for use in the 2011 mode choice analysis.

6.0 Mode Choice Analysis

Mode choice is the third step in the four-step travel demand forecasting process, after trip generation and trip distribution, and before assignment. The first two steps, as described earlier, were accomplished within the trip table development process. The mode choice analysis for the Worcester Commuter Rail Extension Feasibility Study was accomplished in the traditional FTA-recommended manner using a regionally calibrated binary choice model that accounts for all major determinants of travel choice.

The CTPS mode choice model was used to allocate person trips to the two primary competing modes -- auto and transit. This allocation is based on the desirability or utility of each choice a traveller faces, which in turn, is based on the attributes of that choice and the characteristics of the individual. The transit person trips resulting from the model were assigned to the transit network to yield estimates of boardings.

The model requires several pieces of information as inputs. Derivation of transit and highway skims, the most important inputs, was described earlier. In addition, the model also requires CBD parking costs, automobile operating costs, transit fares, zonal socioeconomic data such as automobiles per capita, etc. The 2011 transit fares for the proposed commuter rail line were made consistent with those on existing rail lines that extend as far from Boston as this would. The proposed rail stations were categorized by fare zone as follows:

Station	Fare Zone
Framingham	5
Ashland	6
Westborough	7
Grafton	9
Millbury	10
Worcester	10

7.0 Transit Trip Assignment

Assignment of transit trips (output from the mode choice model) to the transit network is the last step in the traditional four-step travel demand forecasting process. The process allocates transit trips to individual routes in the network, and yields printouts of boardings by station and line. The transit paths, described earlier, are input to the assignment process. The accuracy of the passenger boardings produced by the assignment process depends on the size of the zones used in the analysis. In general, the finer the zone system, the more accurate is the transit assignment. In this study, the zone size in the study area was made identical to the city and town boundary because the 1990 Journey-to-Work Census data were available only at that level. From past experience, we knew that the transit assignments resulting from a coarse zone system would be very lumpy and difficult to interpret. Therefore, we followed different approach in which we allocated the transit trips to the proposed rail stations manually using a procedure described below.

The estimated 2011 transit trips from each city and town in the study area to Boston CBD and Cambridge are shown in Table 2. These trips were allocated to each station on the proposed commuter rail extension manually. First, each town or city was subdivided into four quadrants based on highway network and general accessibilty. Then the total transit trips originating from each town were distributed to its four quadrants based on the density of their residential development. The transit trips from each quadrant were allocated to a nearby station which minimized the total cost and travel time for the passenger. In most cases, the station choice for different quadrants within a city or a town within the study area was clear. For those quadrants which had multiple station choice, we further subdivided the trips and allocated them to nearby stations using the procedure described above.

The parking demand at each new station was estimated by first subtracting the walk trips from the total transit trips and then by applying an auto occupancy rate to convert the remaining auto access trips to equivalent parking spaces. In this analysis, parking turnover was not taken into account. It would not be desirable to size a parking facility in such a way that the last driver takes the last parking space: the capacity of a parking facility should be greater than its demand to provide good service, as a roadway is designed to provide a "B" or "C" level of service rather than "E". The capacity of a parking facility should be greater than its demand for the purpose also of accomodating fluctuation of demand because the estimated demand represents the value on an average day of the year.

APPENDIX E

MASSACHUSETTS RAILWAY ASSOCIATION VEGETATION MANAGEMENT PLAN (VMP)

CONRAIL YEARLY OPERATIONAL PLAN (YOP)

VEGETATION MANAGEMENT PLAN

FOR:

Amtrak, National Railroad Passenger Corporation

Bay Colony Railroad Corporation

Central Vermont Railway Inc.
(New England Central Railroad)

Conrail, Consolidated Rail Corporation

Housatonic Railroad Company, Incorporated

MBTA, Massachusetts Bay Transportation Authority
Commuter Rail (Purple Lines)

Massachusetts Central Railroad Corporation

Pioneer Valley Railroad Company, Incorporated

Providence and Worcester Railroad Company

For railroad rights-of-way in the Commonwealth of Massachusetts

1 January 1995

Prepared by:

Massachusetts Railway Association

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF FOOD AND AGRICULTURE
100 CAMBRIDGE ST., BOSTON, MA 02202 617-727-3000 FAX 727-7235

WILLIAM F. WELD
Governor

ARGEO PAUL CELLUCCI
Lt. Governor

TRUDY COXE
Secretary

JONATHAN L. HEALY
Commissioner

February 7, 1995

Mr. Wayne Duffett
169 Front Street
South Portland, Maine 04106

Re: Massachusetts Railroad Association Vegetation Management Plan Approval

Dear Mr. Duffett:

The Department is satisfied that you have modified the document (VMP) to incorporate the comments of VMP Advisory Panel.

The Massachusetts Railroad Associations Vegetation Management Plan is approved as submitted, effective January 1, 1995 through December 31, 1999, unless suspended, modified or revoked by the Department pursuant to 333 CMR (11.00 all).

Sincerely,

Gail Kaprielian
Pesticide Bureau Chief

recycled paper

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RAILROAD VEGETATION MANAGEMENT PLAN

I. SUMMARY OF RAILROADS COVERED BY THIS PLAN

A. Railroads Operating Under this Plan

The following railroad companies have agreed to use this Vegetation Management Plan (VMP) for the next 5 years:

Amtrak, National Railroad Passenger Corp.
Bay Colony Railroad
Central Vermont Railway (New England Central Railroad)
Conrail, Consolidated Rail Corp.
Housatonic Railroad
MBTA, Massachusetts Bay Transportation Authority Commuter Rail (Purple Lines)
Massachusetts Central Railroad
Pioneer Valley Railroad
Providence and Worcester Railroad Co.

B. Variations From Basic Plan

Differences in company size and work procedures require minor variations in the basic plan. These variations occur in two areas-differences in personnel and different types of sensitive area markers. Appendix A provides details of specific variations for each railroad company.

II. INTRODUCTION

The proceeding report is a generic VMP for the railroad industry within the Commonwealth of Massachusetts. It describes a variety of operational practices which include physical, chemical, and natural methods, used to manage, control, and eradicate vegetation on railroad Rights-of-Way (ROW's). This VMP outlines and interprets the 5-year program for managing vegetation as per 333 CMR 11.00 Rights-of-Way Management (Appendix B). The VMP addresses the major components of the overall procedures in vegetation management, including the rationale for the various techniques, the buffering and protection of sensitive areas, the application of Integrated Pest Management (IPM) techniques, and an overview of the railroad ROW system. Appendices include Massachusetts Laws and Regulations with regard to ROW management and wetland delineation, information concerning the persons who prepared the VMP, references, and variations to the plan for various rail companies.

To understand the complexities of the railroad ROW and the related problems which arise naturally in vegetation management and interfere with the operating railroad system, one will find detailed descriptions and illustrations of the specific areas along the railroad ROW (Sections III and IV). Knowledge of the role and function of each area along the ROW is necessary to assess and understand the particular type of vegetation management practice used in those areas.

The railroad ROW's are unique in that they are all owned by the various railroad corporations and are constructed as per Federal and state laws, regulations, and standards for a specific purpose which benefits the public welfare. Railroad ROW's are similar to other ROW's in that they pass through a wide variety of both privately and publicly owned land. Railroad companies own their ROW's in fee, where as electric and pipeline companies usually obtain easements which convey only specific use rights to the easement holder. The railroad ROW connects railroad facilities and can be divided into several distinct areas each of which have different uses and activities and different requirements for vegetation management.

A brief historical overview will demonstrate that today's Railroad Vegetation Management Program represents great changes in the approach, techniques, and methods for vegetation management versus vegetation eradication of years past. These advances are the results of research and the progressive attitudes of the railroad companies to adopt an integrated approach to vegetation control.

Herbicides have controlled unwanted vegetation on railroad roadbeds and in the railroad yards since the 1950's. These herbicides were often applied several times during the year. The rate for these pre-and post-emergent herbicides were listed as great as 100 lbs active ingredient (A.I.) per acre. In the early 1970's herbicides were applied to the adjacent areas to control brush and related vegetation at rates of 25-77 lbs. A.I. as per label instruction. A mixture of the herbicide, Roundup, used commonly for brush control has been reduced from 6 quarts in 1983 to 4 quarts of concentrate in current use. By 1980, the average rate of herbicides applied to railroad ROW had decreased to below 10 lbs. A.I. per acre. Harrison (1985) reports in the Generic Environmental Impact Report and Control of Vegetation on Utility and Railroad Rights-of-Way that in 1981, the average rate of herbicide application was 8.15 lbs. A.I. per acre for the railroad ROW. Today's herbicide label rates for the railroad ROW is now at 4.0 lbs. A.I. per acre or less for the most frequently applied herbicides in Massachusetts.

We must understand that the 10-fold decrease in herbicide use between 1950 and 1980 was not driven by regulation or economics, but was the combined result of research and development, and concern over possible adverse impacts of chemicals on man and his environment. In the last eight years, the label rate of application for railroad ROW herbicides decreased another 3 fold. It should be noted that these products which the railroad industry has selected to apply on their ROW are several times more costly than other ROW herbicides. The evolution of this VMP is the direct result of an awareness of man and environment, highly trained professionals and research, development, and implementation of scientifically sound programs based on an integrated approach to vegetation control.

This VMP outlines the railroad industry's 5-year plan to manage the various parts of the railroad ROW with respect to vegetation control. This document will explain in great detail the goals and objectives associated with vegetation management on the railroad ROW. The VMP represents careful planning, programming, and decision making by a team of highly qualified professionals so that the general welfare and safety of railroad employees and the public at large are ensured, while at the same item, no unreasonably adverse effects are caused to man or the environment. Appendices are included for ease of reference.

III. GENERAL STATEMENT OF GOALS AND OBJECTIVES

The purpose of this VMP is to establish the operations, processes, procedures, and professional guidelines involved in the railroad's overall vegetation management program to control, eradicate, or manage vegetation which interferes with the ROW by causing a reduction in safety to passengers, property or personnel. This plan will document the how's and why's of vegetation management while ensuring no unreasonable adverse effects/risks to the general public and the environment by implementing an IPM approach into all phases. This VMP provides the necessary information, details, responsibilities, references, professional resources, and basic operational procedures to inform municipalities, interested citizens, railroad employees, and contractors regarding the railroads' vegetation management program. Minimizing the risk of unreasonable adverse effects on human health, environment, and sensitive areas while guaranteeing the safety of all people making public passage or performing work on the ROW are the foundation of the railroads' goals and objectives associated with vegetation management.

To ensure safety, physical and visual access to each component of the railroad ROW is required. Only through direct visual inspection of all the components, such as the ballast, ties, spikes, plates, switches, rails, signs, gates, etc., which are located on the various sections of ROW, can the proper maintenance, repair, replacement, and safety of the system be accomplished. The Federal and Massachusetts governments have recognized the importance of safety and have a variety of laws and regulations governing the condition of railroad ROW's.

Federal law requires railroads to control vegetation. Specifically 49 C.F.R. Subsection 213.37 states:

Vegetation on railroad property which is on or immediately adjacent to roadbed, must be controlled so that it does not:

(a) Become a fire hazard to track carrying structures
(b) Obstruct visibility of railroad signs and signals
(c) Interfere with railroad employees performing normal trackside duties
(d) Prevent proper functioning of signal and communication lines
(e) Prevent railroad employees from visually inspecting moving equipment from their normal duty stations

Federal law also requires vegetation to be controlled so it does not obstruct visibility of railroad signs and signals. Visibility is important both for railroad personnel working on or near trains and for motorists crossing railroad tracks. Train engineers and other operating personnel must be able to see all types of railroad signals. These signals indicate the status of the traffic on the track ahead and also indicate when whistles must be sounded as the train approaches a road crossing. Signs also provide other types of safety information as well. Motorists must be able to see trains as they approach railroad crossings and employees must be able to visually inspect moving rail equipment.

Federal laws require vegetation control to ensure proper functioning of signals and communication lines. Trees and plants short out electrical equipment and cause failure of communication systems and signals.

The Massachusetts Department of Public Utilities has broad regulatory authority over railroads. Railroad Safety Regulations 220 CMR 150.00 set forth regulations concerning track inspection, track maintenance, and track alterations.

The statutory and regulatory intent is specific: the safety of the railroad must be guaranteed through inspection, maintenance, and repair of the ROW. Maintenance and inspection require vegetation control management. Clearly the Commonwealth has intended each railroad within Massachusetts to maintain their ROW's, which includes but is not limited to vegetation management, or be in violation of law and

regulations, and subject to liability and fines.

In general, vegetation control by railroads is essential to enable railroad employees to perform normal trackside duties. Vegetation holds moisture and can cause employees to slip or fall while moving rail equipment. Leaves and branches from ROW brush may strike employees leaning out of windows to visually inspect trains or while riding on the sides of rail cars during switching operations. Leaves and twigs may also enter and block engine intake vents. Vegetation can hide litter, rocks, and animals. Finally, it prevents the workers from seeing damaged, broken, or improperly adjusted track. All of these can cause dangerous, even life threatening accidents.

Railroad ROW vegetation is managed in order to:

- Maintain drainage of the track structure
- Maintain visibility for crossings, signals, signs, etc.
- Maintain the safety and health of railroad employees and residents of the Commonwealth of Massachusetts
- Improve working conditions
- Conform with Federal and State laws
- Reduce the source of weed seeds to adjacent fields
- Prevent overgrowth of weeds in urban and suburban areas
- Improve the appearance of the railroad

The roadbed is the area supporting the track. Track carrying structures, such as bridges, support the weight of the train as it passes. Vegetation and moisture on or near wooden components can quickly weaken them beyond the point at which they are capable of supporting normal train traffic, thus causing accidents and derailments. Ties and other wood structures are usually treated with flammable wood preservatives. Even light fires can burn away wood preservatives and allow decay to penetrate and shorten the normal useful life of the wood.

The entire railroad roadbed and adjacent area are designed to carry water away from the tracks. The ballast is the area between and under the ties. It is constructed of large clean, crushed stone, compacted around the ties to support the track. Pore space within the ballast section allows water to drain away from the ties and into drainage ditches which carry water completely away from the track area. Dirt falling from passing

trains, washed or blown in, or carried by animals can provide adequate seedbed areas for some plants. Plant seeds carried to the track area by the same mechanisms as the dirt can sprout and begin to develop. As the sprouts develop they produce fibrous root systems which expand through the ballast and begin to accumulate additional dirt. The fibrous roots of most plants are continuously dying and renewing themselves adding decaying plant material to the accumulating dirt. This mixture of dirt and plant material holds moisture and allows the original plant to develop at a faster rate, provides a better seedbed for new plants, reduces drainage away from the roadbed area, and holds moisture near the ties. Reduced drainage and increased moisture around the ties and other wooden structures encourages decay and reduces the useful life of these structures.

Another problem occurs with the above ground portion of plants growing near the rails. Trains depend on friction between the steel rails and steel wheels for moving and braking. Anything that reduces friction between the wheels and rails can create dangerous problems. A light rain which wets the track can double or triple minimum stopping distances required, depending on the trains total weight, speed, and the slope involved. Most plant tissues are immediately crushed between the wheel and rail, but release water and plant sap which acts as a lubricant just as rain does and may increase stopping distance by the same proportions.

IV. INTEGRATED PEST MANAGEMENT/VEGETATION MANAGEMENT

Integrated Pest Management as performed by the railroads involves careful planning, organizing, coordinating, and implementing an overall program involving all operational departments and personnel, so that all possible techniques of vegetation control will be utilized. By identifying and coordinating the activities of other divisional and operational units such as repair, ballast replacement, construction, communication, and other ROW responsibilities, the railroad can control vegetation as an indirect benefit of their prime goal and function. Thus, unnecessary application of herbicides will be prevented. All non-chemical techniques and methods which remove or control pest vegetation will be identified and integrated into the overall VMP process and the scheduling for all Yearly Operation Plan (YOP) activities. Thus, no sector or area of the ROW will receive herbicide treatment if a routine or operational activity will remove the vegetation during the process. This operational procedure will further reduce the reliance on chemical control and the amount of herbicide applied each year.

The long-term goal for every VMP, railroad or other, is to reduce the need for vegetation management. Whenever possible and wherever consistent with the ROW system, the railroad industry will implement an integrated approach to vegetation management by encouraging plant communities which hinder the development of target vegetation. This integrated vegetation management program, which utilizes physical, chemical, and natural methods to control vegetation, will address public, environmental, and economic concerns by minimizing the applications of and reliance on herbicides. Due to the unique structure of the railroad ROW, different environmental areas on the ROW such as road crossings and yards, each require different levels of vegetation control and will be selectively managed based on the site and target species. Within a framework of IPM, a team of professionals comprised of roadmasters, engineers of track and vegetation control, and herbicide application specialists will develop annual Yearly Operational Plans that select those vegetation control methods which minimize risk for the general public and the environment. Over the 5-year period, the railroad industry will constantly monitor and evaluate the success of their program and integrate appropriate new methods in their VMP and YOPs. Procedures to monitor and evaluate the IPM program are described in detail in Section VIII, pages 23 through 25.

Federal laws require the maintenance of vegetation located on the roadbed and certain other areas. This target vegetation will be totally eliminated from the following areas:

- Ballast section
- Ballast shoulder
- Yards
- Switches, signals, and signs
- Highway grade crossings
- Bridges, bridge abutments, and buildings
- Off-track areas
- Inside of curves

To date, no environmentally and economically feasible and safe alternatives to herbicides have been developed for use in areas of the right-of-way requiring total vegetation control. No mechanical equipment has been developed that will operate in close proximity to the track components in the roadbed area and the movement of trains, often at high speeds, would make manual weed control dangerous. As a result, the integrated approach to vegetation management in these areas is limited to the selective application of herbicides to target vegetation along with control obtained through track maintenance activity. When herbicide use is needed, the type and density of vegetation, site condition, and the time of year will be factors in determining the herbicide type, application rate, adjuvants, and application equipment. These factors will be selected to attain maximum control and minimize any unreasonable adverse effects. In railroad yards and on certain heavily vegetated areas of the ROW< pre-emergent herbicides will be applied which may eliminate a post-emergent treatment that same year. Each

herbicide treatment will be tailored to the specifics of the site, sensitive area proximity, vegetation, and local environmental factors. The specific details will be included in each YOP.

In areas, such as those adjacent to the ROW roadbed, where total vegetation control is not required, various selective vegetation control techniques are practiced. The goal and purpose of this integrated vegetation control approach will be to increase competition for light and growing space with desirable species by selectively eliminating woody species. Throughout the remainder of the VMP, the term brush shall denote target species which interfere with the ROW system and be must be controlled. Shrub shall denote a desirable species (non-target) which can be tolerated on the adjacent area and will be selectively managed. By selectively removing these target species by hand cutting or foliar treatments, the non-target species will not be affected. If a target species capable of resprouting, is hand cut or mowed, a cut stump treatment will be applied to prevent sprouting and the need for further herbicide applications. In the above cases, the target vegetation is eliminated, and the desirable species such as grasses and sedges will rapidly grow and fill the area due to the increased sunlight, water, and nutrients. The selective elimination of woody and brush species is site, species, and density dependent. The selection of technique will also take into consideration the preservation and enhancing of non-target desirable species. In no case would a pre-emergent herbicide be used in these areas.

In certain adjacent areas of the ROW, branches and limbs of trees grow into or have the potential to move into the roadbed area striking trains or fouling overhead communication lines. In these cases, the tree will not be eliminated if a selective side trimming of those encroaching limbs can be made from an aerial lift mounted on hi-rail equipment, or on a truck. Selective side trimming will be done on a site by site basis according to the type and density of target vegetation present and its propensity to invade the roadbed area or foul communication lines. Trees and brush on the ROW which act as a buffer between the adjacent property and ROW will only be managed if they will interfere with the function and safety of the ROW. Selective vegetation management increases desirable vegetation, prevents erosion, and is aesthetically pleasing to adjacent property owners.

Two examples of non-chemical activities which are part of the railroad's integrated vegetation management program are the improvement of clearances under highway overpasses and the underground placement of communication and fiber optic cables. Under this VMP, both of these non-vegetation projects would be identified and incorporated into the program. First, the sites and timing of projects would be integrated into the plan. No

vegetation control would be scheduled for that part of ROW which would be under construction and for the period of time immediately prior and after completion of the project. If selective side trimming of trees on the ROW or adjacent property is necessary, it will be done in accordance with the guidelines set forth in the VMP and YOP.

Bridge reconstruction by the Railroad illustrates two key points of an integrated VMP. No herbicide treatment in the area of reconstruction is necessary immediately prior to or after completion of the bridge project. The adjacent area to the ROW and the embankments to the bridges are seeded with grass. The quick-growing grasses stabilize the soil and slow invasion by brush species. These areas would have received herbicide treatment under non-integrated management.

Fewer applications and reduced reliance on herbicides, as illustrated by these two examples, multiplied several times throughout the system, represent the potential for significant reduction in herbicide use which,in turn, further minimizes the risk of adverse effects on the general public and the environment.

In summation, the VMP of the railroad industry is an integrated plant management program. The railroad's vegetation management programs do not rely on a fixed application schedule or eliminate all vegetation with herbicides in all areas. The ROW will receive a Vegetation Site Inspection monitoring the vegetation on the roadbed and adjacent areas. All operational and divisional activities scheduled for that year will be identified for those sites. If those activities will control the vegetation on those sites, no other vegetation management activities will be contracted. On those areas, in which the vegetation will not be controlled by non-VMP activities an assessment will be performed to determine the most selective vegetation management approach (see Operational Procedure, Section VII).

V. MANAGEMENT REQUIREMENTS OF RAILROAD RIGHTS-OF-WAY

Concern for public and employee welfare and safety is the principle reason for vegetation maintenance on the railroad ROW. Railroads are unique, among the various type of ROW's in their relationship to interstate commerce. Railroads carry a constant flow of raw material and finished products into, out of, and through the Commonwealth of Massachusetts. Major track segments have few alternate or duplicate routes and cannot be closed easily or for long periods of time for vegetation maintenance without major service disruptions. Vegetation maintenance must be scheduled around the normal schedule of rail traffic. Detailed planning and scheduling is required to

accomplish vegetation maintenance activities within a narrow time window. This document reflects the railroad's continuing efforts to review and evaluate vegetation control practices. This effort has led to practices which allow the development of very low-growing vegetation on many areas adjacent to the shoulder (Figure 1).

A. Roadbed

Figure 1 is an artists concept of an idealized railroad ROW. The roadbed is a man-made structure which consists of the rail and ties, ballast, ballast shoulder and its drainage system. The ballast and ballast shoulder are constructed of hard stone which supports the track. It distributes the load on the track evenly and drains water away from the roadbed. The roadbed drainage system is constructed to carry water draining out of the ballast away from the track.

B. Bridges

Open deck bridges, such as some over water, will not be treated. Stonework in bridge abutments and similar structures must be treated because plant roots can loosen and destroy mortar in cracks. The area under bridges will be maintained in low growing vegetation down slope to a point 1
t which native trees and shrubs can be allowed to develop fully without entering the bridge structure.

C. ROW Area Adjacent to the Shoulder

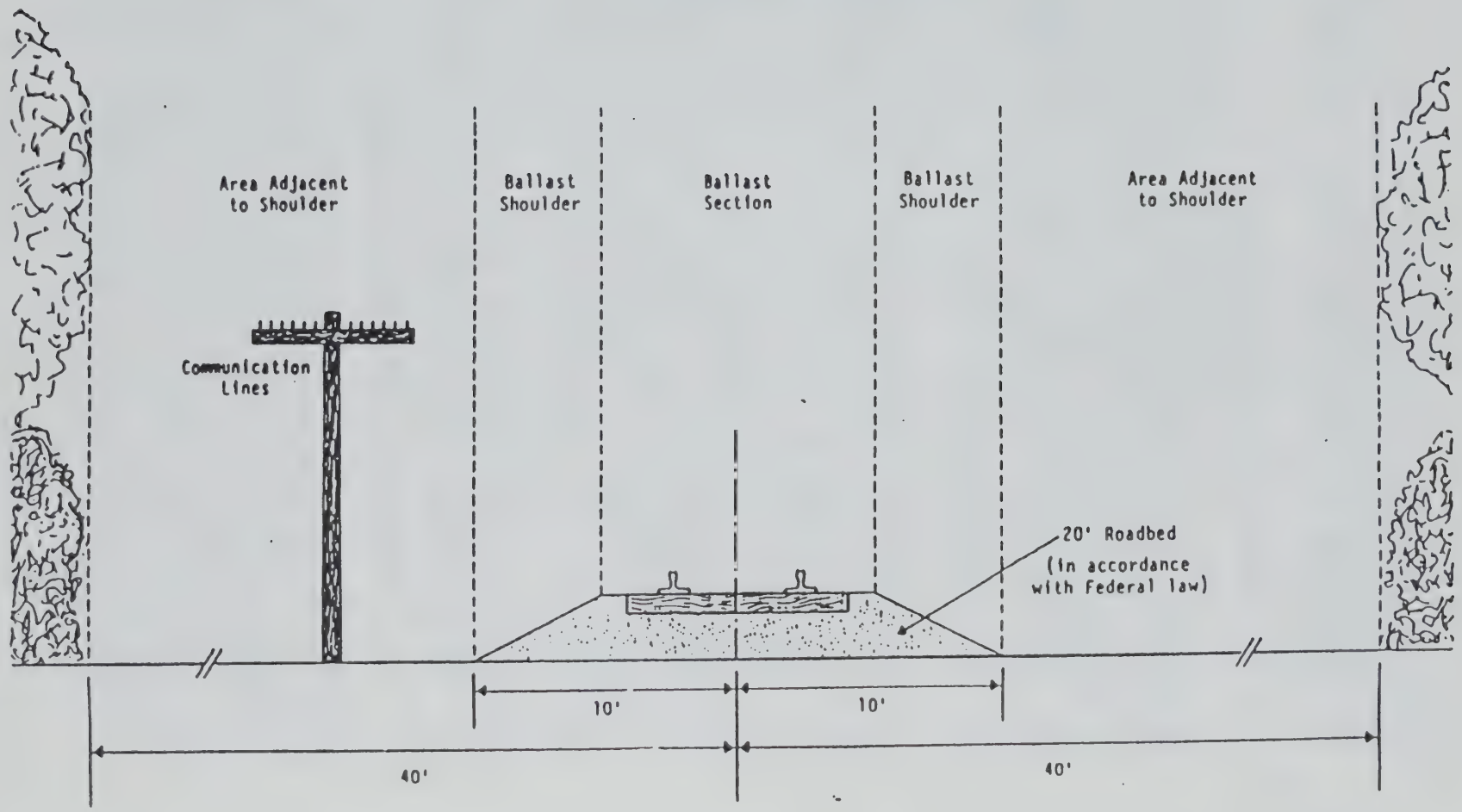
Figure 1 illustrates typical areas on the railroad ROW area adjacent to the shoulder. These areas are generally between the roadbed and the edges of the ROW on either side. Shrubs in these areas provide a visual screen blocking the view of railroad traffic and serve to reduce the noise from rail traffic in adjacent areas. These areas may be maintained to include a wide variety of shrubs and herbaceous plants.

On the side of the ROW containing overhead signal and communication lines, low growing shrubs and most herbaceous plants will be maintained and encouraged in an effort to reduce the invasion of tall growing trees into these areas. Tall growing trees growing near overheard signal and communication lines must be controlled.

Low growing vegetation will be encouraged in areas containing underground communication or signal lines. In areas where above ground lines are present, low growing vegetation will be encouraged on the area opposite the lines. Shrubs in these areas provide a visual screen blocking the view of railroad

Figure 1

Railroad Areas Requiring Vegetation Control
(Line of Road)



traffic from adjacent land owners and also reduce the noise from rail traffic in the adjacent land. Vegetation on the area adjacent to the should must be controlled in the following situations.

1. Grade Level Road Crossings

At grade level road crossings vegetation must be controlled to provide safe lines of sight between motorists and rail traffic.

2. Railroad Signals and Switch Boxes

The area around signal poles and switch boxes will be maintained weed free providing a safe line of sight between the engineer and the signals.

3. Inside Curves

In the area adjacent to the shoulder, on the inside of curves, low growing vegetation must be maintained to allow railroad employees to inspect trains as they move around the curves.

D. Railroad Facilities

Railroad facilities include yards, buildings, fueling facilities, and off-track areas. Yards are areas with multiple tracks and switches where trains are assembled, disassembled, and equipment is stored. Buildings include offices, maintenance and repair buildings, and signal towers, usually within yards. Fueling areas are locations where locomotive fuel is stored and distributed. Off-track areas are locations that are not assessable from rail, such as auto-unloading sites.

Railroad facilities must be maintained weed free to allow safe and efficient operation, reduce fire hazards and permit proper inspection of railroad track.

VI. VEGETATION MANAGEMENT TECHNIQUES

The Railroad's Vegetation Management Program is defined and limited by the construction of the privately owned ROW. The individual components of the railroad ROW as described in Section IV, have two distinctly different vegetation management requirements. On the ROW roadbed and other specialized areas, no vegetation is permitted as per Federal and Massachusetts laws and regulations. On the adjacent areas of the ROW, certain woody, vine and brush species must be selectively managed. Therefore, unlike other ROW's, the methods of railroad ROW management is limited to two basic vegetation

control techniques and one indirect method. The two basic vegetation control techniques are herbicide applications and mechanical techniques. The indirect method includes any ROW operational activity which eliminates vegetation as a secondary benefit.

A. Mechanical Equipment and Techniques

Mechanical control techniques or mechanical cutting techniques are limited to woody and brush vegetation which will include only those target trees that will interfere with the ROW, etc. The mechanical techniques will be used in the areas adjacent to the roadbed. Mechanical control will remove unwanted woody vegetation in areas restricted for herbicide application. As stated prior, these trees and brush interfere with communication lines, reduce visibility, or intrude into the track zone. Therefore, mechanical cutting is a solution to these problems and others.

Mowing is the mechanical process of cutting a woody target species with cutting heads. The cutting heads are mounted on hydraulic arms that greatly extend the lateral reach of the equipment. These machines can be mounted on off-track, on-track, or hi-rail equipment. Large machines are required for railroad application because of the wide range of conditions found on the ROW. On-track equipment has the advantage of not having to operate over rough terrain. Off-track equipment can work independently of train movement but production may be limited by the difficulty of moving over rough terrain. Off-track equipment also has the advantage of being able to operate under communication and signal lines. However, local by-laws or railroad safety guidelines may restrict the use of brush cutters within developed or recreational areas. Mechanical cutters, such as mowers, present certain safety problems which the railroad personnel must take into consideration. Not only is brush cutting potentially hazardous to the general public, but the laborers are at a higher risk during work. In Massachusetts, the compensation rate for workers using cutting techniques is set well above herbicide applicators.

Cutting can be accomplished using chain saws, axes, and other hand tools; however, most railroad cutting is done using rotary-type hydraulic cutting equipment. In certain no-spray and buffer zones, target vegetation may be removed by manual cutting by a ground crew. It must be stated that the entire adjacent area could not be managed with this technique. Lack of skilled woodsmen, prohibitive costs, inaccessible areas, and time requirements are just a few of the factors which prevent the railroad from regressing to this out-dated technique. Likewise manual removal or mowing of the ballast area is

unacceptable because of logistic problems and inefficient vegetation control. Cutting heads are too large to fit between the rails and can only be used on the ballast shoulder. As discussed earlier, plants growing in the ballast quickly produce roots that prevent the flow of water away from the track area. Mechanical cutting of vegetation in the ballast area would only remove the plant tops. The roots would be left to resprout or if killed, will continue to decay, accumulate additional dirt, and hold moisture. Cutting also allows the upper portion of the plant to decay on the site and add to the growing seedbed litter between the stones.

B. Herbicide Application

Herbicides are pesticides used to control unwanted vegetation. Herbicides have been extensively applied on ROW's to control vegetation because of their specificity, range of target species, degree of control, economics, and application methods.

Herbicides are essential to eliminate vegetation on the ROW roadbed (the ballast/shoulder area). There is no known mechanical method for adequate vegetation control on the ROW roadbed as per Federal and Massachusetts laws and regulations. The ballast and shoulder must be free and clear of <u>all</u> vegetation. This requirement necessitates that vegetation be removed down to <u>and</u> <u>including</u> the root system.

A herbicide control program can be modified into an integrated vegetation management approach depending on the area to be treated, target species, time of application, and category of herbicide. The two herbicide categories are pre-emergent herbicides, which the plant absorbs through developing roots before emerging from the ground and post-emergent herbicides, which the plant absorbs through foliage and other green portions, or through woody portions of the plant (i.e. bark, stem, roots)

Target species will be divided into two categories: weeds and brush.

1. <u>Weed Control</u>

The weed control program is designed to eliminate all vegetation located on the roadbed and in the yards. Herbaceous vegetation is the primary cover type with a lesser number of shrubs and tree seedlings also present. A combination of pre- and post-emergent herbicides accomplishes the goal of complete vegetation eradication.

Pre-emergent Herbicide Program:

The pre-emergent herbicide program is directed primarily to the yards, and incorporates IPM to minimize the amount of herbicide used. This program is especially important with regard to employee safety because most employee activities take place within the yards. The scheduling of a main line or yard track section for a pre-emergent herbicide application will depend on a review of the previous year's vegetation density and control efforts and an estimate of vegetation density for the upcoming season.

Pre-emergent herbicide applications within the yards may be accomplished from a hi-rail spray truck. This on-track vehicle has the advantage of not having to operate over rough terrain. These hi-rail trucks have a rear mounted boom located approximately 18 inches above the ground (Figure 2). Spray nozzles are equipped with a spring-loaded shut-off valve to prevent dripping when the pressure is turned off.

Herbicide sprayed from these hi-rail trucks is applied at low pressure between 30 and 40 PSI. Low pressure as defined by CMR 333 11.02 shall be under 60 PSI.

In Massachusetts, pre-emergent herbicide applications to sites needing treatment will be climate dependent; favorable weather conditions are required. Traditionally, with favorable weather conditions, a pre-emergent treatment may begin in March.

Post-emergent Herbicide Program:

The post-emergent herbicide program is directed primarily toward vegetation eradication on the railroad ROW main lines and branch lines.

Post-emergent herbicide application may begin in mid-May but is weather and target species dependent. All treated areas are later inspected and the effectiveness of the treatment is evaluated. If necessary, a second treatment is selectively applied to vegetated areas (see CMR 333 11.03(8)).

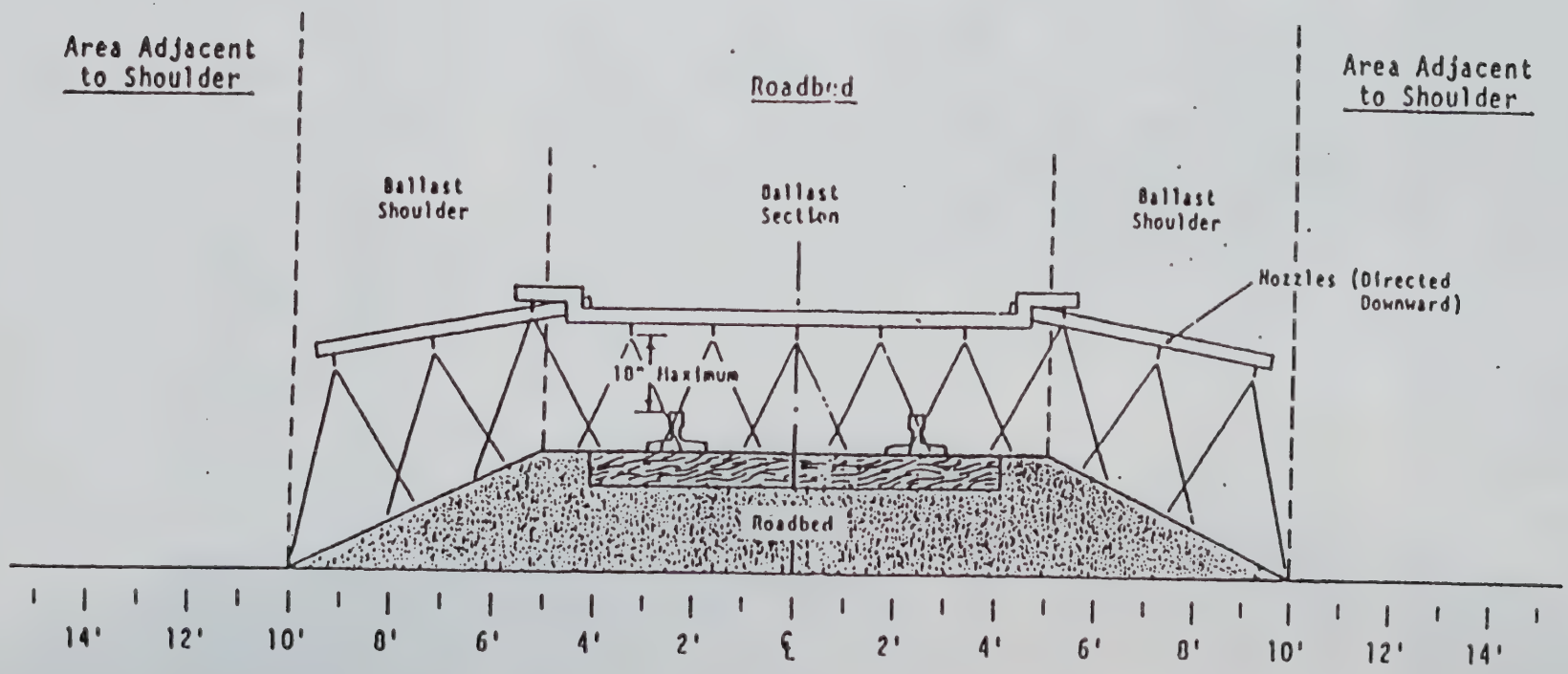
2. Brush Control

The brush control program is designed to control vegetation in areas adjacent to the shoulder through the selective use of post-emergent herbicides. The type of herbicide selected will depend on the species of target vegetation present. The application method will depend on the density of target vegetation and previous mechanical control methods. Shrubs and herbaceous vegetation in these areas are not considered part of the target vegetation.

Figure 2

Typical Spray Pattern

Note: Spray can be controlled to selectively treat all portions (Ballast, Shoulder, and Adjacent Area) or any of the individual portions alone.



There are several methods for the application of post-emergent herbicides to the target vegetation. The variety of methods allow the applicator to selectively apply the herbicide directly onto the target vegetation. These applications are described below:

Foliar:

Selective application of the herbicide to the foliage and or stem by a variety of low-pressure mechanical spray devises. Foliar application is often used for side trimming: selective application of herbicide to the target portions of a tree to selectively terminate said portions without removing the entire tree. This type of application is useful on busy, high speed rail lines where the work intervals between trains are too short for slower mechanical methods. The herbicides are applied under low pressure (30-40 PSI). Selective foliar application will not be used on vegetation over 12 feet in height, except for side trimming (333 CMR 11.03 (5)). During side trimming operations in residential areas, the Railroads will utilize low pressure herbicide application techniques and appropriate adjuvant or agents to reduce the drift of herbicides. Previous studies and experience indicate minimal drift occurs, usually within 5 Ft. of side trimming operations, when using low pressure applications and adjuvants.

Stem:

Selective application of the herbicide in a petroleum or crop oil base carrier to the lower portion of the main stem (trunk of a tree). The equipment for basal spraying is often a manual-pump apparatus.

Cut surface:

Application of a herbicide to the stump immediately after a cutting procedure which may include mowing. Traditionally, the herbicide is manually painted or squirted directly onto the cut stump surface.

Post-emergent herbicides applied to control woody vegetation in the adjacent areas will begin mid-May and may continue throughout the year on selective sections of the ROW as part of the railroad's IPM program. Stem and cut surface treatments are effective year round. As in weed control, all treated areas are later inspected and evaluated. If further treatment is needed, a post-emergent herbicide is selectively applied to unwanted vegetation. Every consideration will be taken to minimize herbicide use while guaranteeing the overall safety of the ROW system.

The beneficial effects of herbicide applications on the ROW system cannot be overlooked for several reasons. The registration of herbicides specifically labeled for use on ROW's by the EPA and Commonwealth of Massachusetts based on risk analysis is further support for their continued use. When applied by a Massachusetts certified applicator (in the category Right-of-Way Pest Control) according to label direction and in accordance with all Federal and State laws and regulations including an approved VMP and YOP, a herbicide selected from the Department of Food and Agriculture/Department of Environmental Protection (DEP) recommended list is expected to have no unreasonable adverse effects to the general public and the environment. Many mechanical techniques present real danger and risk to both the general public and workers. As stated before, no adequate mechanical method is available for controlling vegetation found on the ROW roadbed and other areas which must be kept devoid of all vegetation. Public and employee safety begins with the Federal and state mandated requirements to visually inspect the entire ROW system. Herbicides provide the most reliable and generally safe method to prevent and remove weeds which inhibit said inspections. The Worker Safety Statistics demonstrate the significantly more workers will be injured or killed when using manual or mechanical cutting instead of herbicides. Also, herbicides prevent plants, plant roots and vines from fouling the roadbed ballast. These plants reduce and restrict water drainage from the roadbed. Thus, excess water accelerates the degradation and destablization of roadbed.

Since herbicides are available in a wide variety of dry and liquid forms, the railroad may select the most efficacious herbicide for that particular site and target vegetation. Thus, the target plant may be selectively eradicated while minimizing impacts on nontarget, desirable species. Limited, selective application of herbicides minimizes the chance of unreasonable adverse effects to the general public and the environment. The applicator can also accurately deliver the herbicide to only the target vegetation through the use of adjuvants.

The applicator controls the pressure, selects the proper nozzle, and has absolute control at which speed the vehicle will travel the ROW.

The applicator is constantly monitoring the environment. If the weather conditions change, such as high wind, rain, temperature inversion, etc., the applicator will stop immediately.

The EPA and Massachusetts Law require the applicator to keep daily records of herbicide spraying operations. The records include weather conditions, herbicide/adjuvant mixture components and proportions, equipment, rate of application, adverse conditions, and the exact location of treated and non-treated track and adjacent areas.

In summation, the highly trained professionally certified applicators, under the guidance and supervision of on-site railroad personnel, will apply herbicides chosen from the state recommended list (CMR 333 11.04 (1)(d) specific for the target vegetation and site. By using state-of-the-art equipment and specific adjuvants, the applicator will efficiently and economically manage the vegetation on the ROW.

VII. SENSITIVE AREAS

Sensitive areas have been defined in the Commonwealth of Massachusetts Regulation 333 CMR 11.00. A copy of the regulations is included in Appendix B. Sensitive areas include any areas within the ROW including, but not limited to, the following areas:

a. Within the primary recharge area of a public drinking water supply well
b. Within four hundred (400) feet of any surface water used as a public water supply
c. Within one hundred (100) feet of any appropriately marked private drinking water supply well
d. Within one hundred (100) feet of any standing or flowing water
e. Within one hundred (100) feet of any wetland
f. Within one hundred (100) feet of any agricultural or habitated area

The most common types of sensitive areas encountered are areas within 100 feet of standing or flowing water or wetlands.

Those sensitive areas that have been delineated with permanent markers in the field are a,b,c,d, and e above. Additionally, although these areas are readily identifiable in the field, delineation tags were placed for standing and flowing bodies of water because they may be obscured from the R/W during some season of the year.

Within "sensitive areas" only a limited number of herbicides that have been approved for these areas by DFA and DEP can be applied. The current list of sensitive area approved herbicies is provided in Appendix D. Additionally, no herbicides, including those of which are approved for sensitive areas, can be applied within 10 feet of standing or flowing water.

A. Identification and Location of Wells and Surface Water Supplies

The Commonwealth of Massachusetts, Department of Environmental Protection, Office of Planning and Program Management, Division of Water Supply have developed data and overlay maps highlighting public water supplies, aquifers and drainage basins for most of the State. Areas not covered are clearly identified.

Local sources of specific information included the Conservation Commission, Water Department and Board of Health. Private wells on record with the DFA will be delineated. This information is provided to the railroad through DFA or other State agencies.

Prior to field delineations topographic maps were marked identifying the locations of public wells and water supplies. The specific locations were obtained from overlay maps provided by the DEP and the Division of Water Supply. Public water supplies were marked using the symbol and number codes developed by the Division.

B. Identification and Delineation of Wetlands

The following definition and description is from the Wetlands Protection Act Regulations 310 CRM 10.55 (2):

(c) The boundary of Bordering Vegetated Wetlands is the line within which 50 percent or more of the vegetational community consists of wetland plants species. Wetland plant species shall include but not necessarily be limited to those species identified in the Act. Wetland plant species are also those listed in the National List of Plant Species That Occur in Wetlands: Massachusetts (Fish & Wildlife Service, U.S. Department of the Interior, 1988) with an indicator status of Facultative, Facultative+, Facultative Wetland-, Facultative Wetland, Facultative Wetland+, or Obligate Wetland, and with the addition of Eastern Hemlock (*Tsuga canadensis*) and plants exhibiting physiological adaptations to life in saturated conditions.

(i) The boundary as determined by 50% or more wetland plant species shall be presumed accurate where:

(a) all dominant species have an indicator status of obligate in the vegetational community;

(b) all dominant species have an indicator status of obligate or facultative wetland in the vegetational community and the slope is distinct or abrupt in the area between the nonwetland plant community and the wetland plant community;

(c) The area where the work will occur is clearly limited to the buffer zone, except to site an on-site sewage treatment and disposal system pursuant to 310 CMR 15.000; or

(d) The issuing authority determines that sole reliance on wetland plant species will yield and accurate delineation.

(ii) Where the boundary is not presumed accurate in 310 CMR 10.55 (2)(c)(i) or to overcome the presumption, credible evidence shall be submitted by a competent source, demonstrating that the boundary of Bordering Vegetated Wetlands is the line within which 50% of the vegetational community consists of wetland plants species and saturated or inundated conditions. The issuing authority shall consider or may require credible evidence of saturated or inundated conditions when determining the boundary. Indicators of saturated or inundated conditions sufficient to support wetland plant species shall include one or more of the following:

a. groundwater, including the water table, within the major portion of the root zone;
b. observation of surface water;
c. characteristics of hydric soils, as described in the Corps of Engineers Wetlands Delineation Manual dated January 1987.

(iii) Where vegetation or site has been disturbed (e.g. cutting, removing or other destruction of vegetation, the boundary is the line within which there are indicators of saturated or inundated conditions sufficient to support wetland plant species or other credible evidence from a competent source that the area supported wetland plant species prior to the disturbance.

The following field guides are valuable resources providing lists and descriptions of wetland plants in Massachusetts and the surrounding region. Helpful field guides include:

- Field Guide to Wetland Plant Identification
- Freshwater Wetlands: A Guide to Common Indicator Plants of the Northeast
- Inland Wetland Plants of Connecticut
- Massachusetts Wetlands Protection Act (MGLC.131.s.40)
- Guide to Inland Vegetated Wetlands in Massachusetts
- US EPA New England Plant Identification and Protection Laws
- Wetland Plants of the State of Massachusetts

Small wetlands, variable wetland situations, and the specific boundary to any wetland must be determined in the field.

The wetland maps listed below provide a general guide to the location of wetlands.

- US Fish & Wildlife Service National Wetlands Inventory Maps (scales of 1:24,000 and 1:25,000); available from the University of Massachusetts/Amherst, Cartographic Information Research Services.
- DEP Wetlands Restriction Maps (scale <u>usually</u> 1:1,000); about 15% of the state has been mapped; contact the Division of Wetlands and Waterways to request maps.
- US Soil Conservation Service Maps (scales vary); available for most communities: note mulch and peat soils.
- US Geological Survey Topographic Maps (scale of 1:25,000); shows major wetland areas; older maps useful for locating small streams; historical flood records also available.

- McConnell Land-Use Maps, available from the University of Massachusetts/Amherst, Department of Forestry and Wildlife Management; delineates wetlands using aerial photos (scale 1:25,000) and quantifies wetland acreage from years 1951, 1971, and, for part of the state, as recently as 1990. (Caution: some forested swamps not included in wetland classification.)

- Regional Planning Agencies' 208 Water Quality Survey wetlands maps (scales vary); not all planning agencies have copies.

- US Army Corps of Engineers wetlands maps (scales vary); usually done for a specific program such as Natural Valley Flood Storage Project; historical flood elevation records also available.

- Federal Emergency Management Agency (formerly under the U.S. Department of Housing and Urban Development) has delineated 100-year and 500-year floodplain elevations for most of the communities in the Commonwealth (scale 1"-400'); small streams often omitted; towns should request more detailed mapping if many flood-prone areas are excluded or if no map is yet available. Although the 100-year floodplain boundary rarely coincides with the vegetated wetland boundaries, these wetlands frequently occur within the 100-year floodplain.

C. Field Procedure

1. Preparation

Prior to doing the field work, appropriate field maps will be consulted to determine the general location of sensitive areas on the railroad ROW.

2. Boundary Establishment

The sensitive area boundaries which are not readily identifiable in the field will be established for these areas. All boundaries use minimum distances specified in the regulations. In most locations the delineation marker was placed as much as 15 feet beyond the minimum in order to find the best, strongest, and most visible location for the marker.

The occurrence of standing water in man-made drainage ditches will not be used as a principal indication of wetlands. The four major indications are vegetation, topography, soils, and hydrology. (Hydrology of a site relates to the distribution and circulation of water on the surface and in the soil).

Vegetation and signs of obvious hydrology will be used to determine wetland boundaries according to the DEP Wetland Protection Act Regulations. Soils are helpful in verifying wetland boundaries, but will not be used as a determining factor in typical situations. Vegetation responds quickly to changes in soil moisture and drainage. Plants are more likely to indicate newly forming wetlands, or wetlands that are in the process of enlarging. Soils are useful as indications of long-term hydrologic conditions. They are especially useful for disturbed sites and drier wetlands lacking typical wetland plants.

Topographic depressions where water collects, or where the water table is close to the surface, usually allow the development of wetlands. The boundary of a wetland in a low, flat area surrounded by hilly terrain often corresponds to the "break" in the slope, or the point at which the land begins to flatten.

Once the boundary of a wetland has been established distances will be measured to establish appropriate no-spray and buffer zones. Permanent markers will be installed along the ROW and color coded in order to indicate the proper spray status of the area to the herbicide applicator.

3. <u>Approval of Findings</u>

The Conservation Commission of each municipality was given the opportunity to observe and inspect the wetland delineation markers. A request for a determination of applicability was filed with each conservation commission pursuant to the Wetland Protection Act regulations, 310 CM 10.05 (3)a.2. Form 1 was accompanied by a map of the ROW indicating the areas and type of delineation which was made. These determinations are effective for the duration of the VMP as specified in 310 CMR 10.05 (3)(b)(1).

Data relating to the following is submitted to the Conservation Commission in each town as part of the Yearly Operational Plan.

- Maps, or updates thereof, locating the ROW and Sensitive areas not readily identifiable in the field.
- Herbicides proposed including application rates, carriers, adjuvants
- Herbicide application techniques and alternative control procedures proposed
- The company which will perform any herbicide treatment
- Identification of target vegetation
- Individual representing applicant supervising YOP
- Flagging methods to designate sensitive areas on the ROW
- Herbicide Fact Sheets as approved by the Department
- Procedures and locations for handling, mixing, and loading of herbicide concentrates.

D. Operational Strategies and Procedures

Vegetation control procedures within the railroad ROW will be made consistent with all state and Federal regulations.

The general vegetation control strategies will exclude the use of herbicides in any application which would result in drift to:

1. Any area within 10 feet of standing or flowing water,
2. Or an area within 400 feet of a public drinking water supply well,
3. Or an area within 100 feet of any surface water used as a public water supply,
4. Or an area within 50 feet of a private drinking water well marked in accordance with 333 CMR 11.04 (2)(c)3.

On the railroad roadbed no suitable alternative to herbicide vegetation control is currently available. On all other areas mechanical methods will be the treatment of choice. In the years following mechanical vegetation control, herbicide treatments may be used to control vegetation regrowth. The selection of the herbicide and method of application will depend on the type and density of target vegetation present. In the area adjacent to the shoulder where herbaceous and some low-growing, woody plants can be encouraged, selective cutting of tall-growing trees will be used as needed.

All notification procedures required by State regulations will be followed. Several days prior to scheduled maintenance activities, a railroad track inspector or other person familiar with the delineation marking system assigned to the task, and equipped with delineation maps and/or log sheets, will review the area scheduled for treatment to ensure all delineation markers are in place and visible.

Immediately before beginning any herbicide application, the applicator will review with "the Railroad" officials the location of all sensitive areas not readily identifiable in the field but marked with delineation plates. They will also review sensitive areas which can be readily identified in the field; these are agricultural and inhabited areas.

A railroad company pilot vehicle will proceed through an area scheduled for herbicide application, approximately 1/4 mile ahead of the spray vehicle. An observer in the pilot vehicle will be trained to recognize the delineation markers and readily identify all types of sensitive areas. As the pilot vehicle passes a delineation marker, the operator will signal the application vehicle to ensure that proper action is taken by the application vehicle. When moving into or out of no-spray areas, the worker in control of the spray vehicle, will be signaled by another employee or by the pilot vehicle, to cease or commence spraying.

VIII. OPERATIONAL GUIDE LINES FOR APPLICATORS RELATIVE TO HERBICIDE USE

A. Guidelines for Sensitive Areas

1. Site Review

On sites believed to need vegetation control a review of the vegetation conditions will be made. The review will be made by the track inspector or other person experienced in vegetation management. On the areas adjacent to the shoulder, the need for and type of control will be identified and the treatment required will be determined. The density and type of target species present will be noted in each area for use in developing a control strategy.

2. Office Procedures

All available information will be analyzed in the following way. Areas scheduled for construction or other activity that will relate to or eliminate the need for vegetation maintenance, at that time, will be identified. If the vegetation on these areas will be controlled or eliminated, they will be removed from further consideration in the program now being developed. Next, the sensitive areas delineated will be reviewed to ensure that appropriate measures have been taken to protect these areas. The treatment methods prescribed in each sensitive area buffer zone will be reviewed and, whenever possible, a mechanical or more selective herbicide application prescribed. No-spray areas will be reviewed as to the overall vegetation conditions occurring, and mechanical methods will be used to selectively remove or side trim trees leaning into the roadbed area. New and developing vegetation control techniques will be reviewed to determine whether or not a suitable alternative to herbicide applications has been developed for use on the roadbed in sensitive areas.

This analysis will provide the site specific information required in the YOP. The YOP will be developed and submitted to DFA for approval as per 333 CMR 11.06(1).

B. Preparation for Herbicide Application

At least a 21-day notice prior to the scheduled application date, will be given to the Conservation Commission, Board of Health, and Mayor of each community following Massachusetts State regulations.

Prior to the scheduled application date, a qualified railroad employee will traverse the treatment area with the sensitive area maps and record to ensure that all delineation markers are in place and visible.

1. Basic Requirements

To protect the public welfare and eliminate adverse impacts on the environment, railroad herbicide application crews must have an operator who is licensed and certified in the State of Massachusetts. Applicators must also have a licensed and certified Field Supervisor who reports daily to "The Railroad" or other qualified railroad employee who is assigned to this task. "The Railroad" is responsible for adherence to this VMP by railroad employees or their contractor. Applicators must follow all railroad safety regulations and all herbicide label directions.

a. Daily Field Report of Vegetation Control Activities

The daily field report of Vegetation control activities will be filled out each day by operators doing the work. The daily field report will include, but not be limited to:

- Date
- Vehicle and Equipment Numbers
- Track Name, Number, and Designation
- Chemical Received

- From
- Chemical Name
- Number of Containers
- Quantity lbs./gals.

- Chemical Left or Forwarded

- To
- Vehicle Number
- Number of Containers
- Quantity lbs./gals.

- Weather

- Wind Velocity at time	6am	9am	12noon	3pm	6pm
- Wind direction at time	6am	9am	12noon	3pm	6pm
- Temperature at time	6am	9am	12noon	3pm	6pm
- Rain (in inches) at time	6am	9am	12noon	3pm	6pm

- Acres Treated

- Roadbed Area
- Area Adjacent to the Shoulder
- Mainline
- Sidings
- Branch

- Industrial Track
- Bridge
- Crossings

- Daily Summary

- Beginning Time
- Ending Time
- Hours Treating
- Total Hours Reported
- Daily Beginning Odometer Reading
- Daily Ending Odometer Reading

- Contractor Person on Job (list each individual)
- Railroad Person on Job (list each individual)
- Daily Summary of Chemicals Applied

- Name
- EPA Establishment No.
- EPA Registration No.
- Concentrate:gals/lbs.
- Mix Rate and Application Rate per Acre

- Tank or Mix Number

- Chemical Name and Amount Added to Tank
- Water in Gallons or Inches of Depth
- Adjustments Names and Amount
- Location Where Water Taken

b. Herbicide Application Log

In addition to a daily Field Report, a Herbicide Application Log will be filled out. the herbicide log will include, but not be limited to :

- Time
- Mile Post and Location
- Spray Type and Meter Reading
- Gallons Per Mile
- Remarks: Spray Plan, City, Vegetation, Weather, etc.

2. **Herbicide Application**

The applicator will not handle, mix or load herbicide concentrate on a ROW within 100 feet of a sensitive area. Whenever possible, the applicator will handle, mix, or load herbicide while parked on a non-porus surface such as concrete or asphalt, but not within 100 feet of a sensitive area.

At the time of treatment, before the application begins, the herbicide applicator will review the sensitive areas, maps, and records with a qualified railroad employee. A pilot vehicle will proceed through the area approximately ¼ mile ahead

of the spray vehicle. As the pilot vehicle passes a delineation marker or a sensitive area readily identifiable in the field, the operator will signal the spray vehicle, so that he may modify his operation appropriately. In no-spray areas, as the applicator passes the boundary, he will verify that no herbicide is deposited in the area with the assistance of another employee.

Water for mixing of herbicide may be obtained, in accordance with local ordinances or regulations, from ponds and streams using tanks and hoses equipped with DEP approved anti-siphon device to keep herbicide from flowing back into the source following (CMR 333 10.03-15,16,17).

IX. ALTERNATIVE LAND USE

"The Railroad" will review and evaluate new and innovative alternative land uses on the ROW. Safety considerations preclude most alternative land uses on the railroad ROW. The size, weight, and speed of trains and their cargoes being transported are hazardous to any activity inside the ROW boundary. Even agricultural activities might interfere with the operation of the railroad by reducing visibility to inspect trains and impeding drainage away from the ballast area.

Some uses of the ROW that are compatible with railroad uses include construction and maintenance of electric distribution and transmission lines, telephone lines, and cable TV lines. Other uses that may be used on wider railroad ROW's are sewer and water lines and major pipelines.

Parties interested may submit alternative land use proposals for "The Railroad's" consideration. A list of addresses for railroads participating in this plan may be found in Appendix A.

X. REMEDIAL PLAN TO ADDRESS SPILLS AND RELATED ACCIDENTS

This remedial plan is offered as a guide to proper procedures for addressing pesticide accidents. Since every incident is different, applicators must weigh factors specific to the situation and use their own judgment to decide the appropriate course of action. Because applicators normally carry only small amounts of herbicides, the potential for serious accidents is relatively small.

Federal and state statutes establish emergency response procedures that must be followed by the companies and their contractors in the event of a spill or related accident. Under the Federal Environmental Pesticide Control Act, it is the applicators legal responsibility to clean up pesticide spills resulting from their use and handling of the product. applicators are liable for damages, subject to penalties, and obligated to clean up and decontaminate areas resulting from pesticide spills.

The Comprehensive Environmental Response, Compensation, and Liability Act 1980 (CERCLA) 42 U.S.C. §9601 et. seq., and the Federal Water Pollution Control Act (CWA) 33 U.S.C. §125 et. seq. are aimed at eliminating the accidental discharge of oil and hazardous substances into the environment, providing for the cleanup of such substances, and establishing responsibility for costs of cleanup. CERCLA and CWA are implemented by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 CFR §300 et. seq.

Massachusetts General Laws Chapter 21E, the Massachusetts Oil and Hazardous Material Release Prevention and Response Act, Section 3 authorizes the Massachusetts Department of Environmental Protection (DEP) to act to secure the benefits of the CWA and CERCLA to the Commonwealth by promulgating and enforcing a Massachusetts Contingency Plan, 310 CMR 40.000, establishes standards and procedures for the discovery of discharges, notification of DEP, assessment of the problem, and implementation of appropriate remedial response actions, as set forth in 310 CMR 40.500.

The Farm Chemical Handbook (published by Meister Publishing Co., Willoughby, Ohio), U.S. Department of Transportation "1987 Emergency Response Guidebook" (available from UNZ and Company, Jersey City, New Jersey), herbicide labels, and material safety data sheets provide reference information for the chemicals being used. Applicators should carry equipment for emergency action including sand or other absorptive material, broom, shovel, and heavy duty plastic bags or other leak-proof sealable container.

XI. IDENTIFICATION AND QUALIFICATIONS OF INDIVIDUALS DEVELOPING THE PLAN

This Vegetation Management Plan was developed for Conrail in 1989 by Environmental Consultants, Inc. (ECI). Mr. Paul A. Johnston was the Project Manager. Mr. Johnston has a B.S.in Forest Resources Management and a M.S. in Silviculture from West Virginia University. Mr. Frank DeVilbiss, Engineer of Vegetation Control for Conrail, assisted Mr. Johnston with preparation of the Plan. Mr. DeVilbiss has a B.S. in Forestry from Pennsylvania State University and has over twenty years of experience in all aspects of vegetation management.

With approval from the Department of Food and Agriculture, the Vegetation Management Plan was subsequently adopted for use by other members of the Massachusetts Railway Association (MRA) including: Amtrak, Bay Colony Railroad, Central Vermont Railway, Housatonic Railroad, Massachusetts Bay Transportation Authority, Massachusetts Central Railroad, Pioneer Valley Railroad, The Providence and Worcester Railroad.

This first revision of the Vegetation Management Plan was developed by the Massachusetts Railway Association's Maintenance of Way Committee. Members of the Committee who participated in the redrafting of this Plan include: Mr. Eli Mistovich, Amtrak; Mr. Wayne Duffett, Bay Colony Railroad; Mr. Michael Olmstead, Central Vermont Railway; Mr. Frank DeVilbiss, Conrail; and Mr. Scott Conti, Providence and Worcester Railroad.

APPENDIX A

VARIATIONS FROM BASIC PLAN

1. Personnel
2. Sensitive area markers

1. CONTACT PERSON FOR PARTICIPATING RAILROADS

1. MR. ELI MISTOVICH
   AMTRAK
   NATIONAL RAILROAD PASSENGER CORPORATION
   32 COBBLE HILL ROAD
   SOMERVILLE, MA 02143

2. MR. WAYNE DUFFETT
   BAY COLONY RAILROAD CORPORATION
   420 WASHINGTON STREET
   BRAINTREE, MA 02184

3. MR. MICHAEL OLMSTEAD
   CENTRAL VERMONT RAILWAY (N.E. CENTRAL RAILROAD)
   2 FEDERAL STREET
   ST. ALBANS, VT 05478

4. MR. FRANK DEVILBISS
   CONSOLIDATED RAIL CORPORATION
   2001 MARKET STREET 10-B
   P O BOX 41410
   PHILADELPHIA, PA 19101-1410

5. MR. JOHN HANLON
   HOUSATONIC RAILROAD COMPANY, INC.
   PO BOX 1146
   CANAAN, CT 06018

6. **MASSACHUSETTS BAY TRANSPORTATION AUTHORITY(AMTRAK)**
   500 ARBORWAY
   JAMAICA PLAIN, MA 02130

7. MR. FORREST VAN SCHWARTZ
   MASSACHUSETTS CENTRAL RAILROAD CORP.
   ONE WILBRAHAM STREET
   PALMER, MA 01069

8. MR. MARC LEVINE
   PIONEER VALLEY RAILROAD
   PO BOX 995
   ONE DEPOT STREET
   WESTFIELD, MA 01086

9. MR. SCOTT CONTI
   PROVIDENCE & WORCESTER RAILROAD COMPANY
   P O BOX 16551
   WORCESTER, MA 01601

2. SENSITIVE AREA MARKERS

Sensitive area markers presently in use may be one or any combination of the following:

a. Plates - Color coded metal plates nailed to the railroad ties
b. Paint - Paint applied to the web or base of the rails
c. Posts - Color coded posts adjacent to the track

Sensitive area markers presently employed by participating railroads are as follows:

Amtrak/MBTA Commuter Rail - plates, paint and/or posts
Bay Colony Railroad - plates and/or paint
Central Vermont Railway - plates and/or paint
(New England Central Railroad)
Conrail - plates and/or paint
Housatonic Railroad - plates and/or paint
Massachusetts Central Railroad - plates and/or paint
Pioneer Valley Railroad - plates
Providence & Worcester Railroad - plates

Additional details concerning sensitive area markers may be found in the Yearly Operational Plans issued by participating railroads.

APPENDIX B

333 CMR 11.00: Right of Way Management

333 CMR 11.00: RIGHTS OF WAY MANAGEMENT

Section

11.01: Purpose
11.02: Definitions
11.03: General Provisions
11.04: Sensitive Area Restrictions
11.05: Vegetation Management Plan (VMP)
11.06: Yearly Operational Plan (YOP)
11.07: Public Notification
11.08: Notice of Modification and Revocation
11.09: Right-of-Appeal
11.10: Penalties

11.01: Purpose

The purpose of this chapter is to promote the implementation of Integrated Pest Management (IPM) Techniques and to establish those standards, requirements and procedures necessary to minimize the risk of unreasonable adverse effects on human health and the environment associated with the use of herbicides to maintain rights-of-way and to establish a statewide and uniform regulatory process. These regulations establish procedures which guarantee ample opportunity for public and municipal agency review and input on right-of-way maintenance plans.

11.02: Definitions

For the purpose of 333 CMR 11.00, the following definitions shall apply.

Agricultural Area, shall refer to, but not be limited to, actively cultivated gardens, greenhouses, orchards, fields, pastures, and other areas where herbicides might impact adversely on the vegetation under cultivation or agricultural management.

Applicant, shall refer to any person representing federal, state or local governments or agencies, utilities, railroads, pipelines, that intend to maintain a right-of-way by the application of herbicide.

Ballast, shall refer to the coarse gravel or crushed rock onto which the ties, tracks and any switching, signaling and communication devices of a railroad are laid.

Broadcast, shall refer to any non-selective herbicide application technique which results in application to all vegetation within a target area.

Department, shall refer to the Department of Food and Agriculture.

Foliar Treatment, shall refer to any technique which applies herbicide to leaves of the target vegetation.

Inhabited Area, shall refer to, but not be limited to residences, schools, hospitals, parks and recreational facilities or other areas in which humans generally live, work or gather.

Low Pressure, shall refer to pressure under 60 psi.

Maps, shall refer to maps which are of such accuracy and scale, as determined by the Department, to provide sufficient detail so that sensitive areas can be delineated, or which show bench marks or other permanent structures located on the right-of-way which allow the delineation of sensitive areas.

Person, shall refer to, but is not limited to, an individual, association, partnership, corporation, company, business organization, trust, estate, the Commonwealth or its political subdivision, administrative agencies, public or quasi-public corporation or body, or any other legal entity or its legal representatives, agent or assignee, or a group of persons.

Person aggrieved. shall refer to any person who, because of an act or failure to act by the Department may suffer an injury in fact which is different either in kind or magnitude from that suffered by the general public and which is within the scope of the interests identified in these Regulations. Such person must specify in writing sufficient facts to allow the Department to determine whether or not the person is in fact aggrieved.

Primary Recharge Area. that land area delineated by Zone II as defined in 310 CMR 24.06 or in such cases as when the primary recharge area has not been designated it shall be, in the interim, be defined as a one half mile radius from the public drinking water supply well unless otherwise determined by the Department of Environmental Protection.

Right(s)-of-Way (ROW). for the purpose of this regulation shall refer to any roadway, or thoroughfare on which public passage is made and any corridor of land over which facilities such as railroads, powerlines, pipelines, conduits, channels or communication lines are located.

Selective Application. shall refer to the application of herbicide, in such a manner that the delivery to the target vegetation is optimized and delivery to non-target vegetation and the environment is minimized.

Sensitive Areas. shall refer to any areas, within rights-of-way, including but not limited to the following, in which public health, environmental or agricultural concerns warrant special protection to further minimize risks of unreasonable adverse effects:

(a) within the primary recharge area of a public drinking water supply well;
(b) within 400 feet of any surface water used as a public water supply;
(c) within 100 feet of any identified private drinking water supply well;
(d) within 100 feet of any standing or flowing water;
(e) within 100 feet of any wetland;
(f) within 100 feet of any agricultural or inhabited area.

Stem Treatment. shall refer to any technique including stump, basal, stem, injection, banding, frill, girdle and any other treatment which delivers herbicide at low pressure to the stump, base or stem of the target vegetation.

Target Vegetation. shall refer to any plant species which has the potential to interfere with the operation of the rights-of-way.

Touch-up Application. shall refer to limited application of herbicides following an initial treatment, which is necessary to achieve the desired vegetation control.

Vegetation Management Plan (VMP). shall refer to a long term management plan for the applicant's right-of-way system which describes the intended program for vegetation control over a five year period.

VMP Advisory Panel. shall refer to the Vegetation Management Plan Advisory Panel as set forth in 333 CMR 11.05(4).

Yearly Operational Plan (YOP). shall refer to the yearly operational plan which describes the detailed vegetation management operation for the calendar year consistent with the terms of the long term Vegetation Management Plan.

Water Supply. shall refer to any raw or finished water source that is presently used, reserved for future use, or under investigation for future use by a public water system as defined in 310 CMR 22.02, or used as a source of private drinking water by one or more persons. This shall include all land and waters used as, or tributary to, a public water system except those exempted under 310 CMR 22.20.

Wetlands. with the exception of land subject to flooding shall refer to areas subject to protection under M.G.L. c. 131, s. 40 which include the following areas as defined in 310 CMR 10.02(1)(a) - (c):

(a) Any bank, any freshwater wetland, any coastal wetland, any beach, any dune, any flat, any marsh, or any swamp bordering on the ocean, any estuary, any creek, any river, any stream, any pond, or any lake

(b) Land under any of the water bodies listed above

(c) Land subject to tidal action

11.03: General Provisions

(1) No person shall use an herbicide for the purpose of clearing or maintaining a right-of-way unless appropriately certified by the Department or unless appropriately licensed by the Department and working under the on-site supervision of an appropriately certified applicator.

(2) No person shall use an herbicide for the purpose of clearing or maintaining a right-of-way except in accordance with a Vegetation Management Plan (VMP) and a Yearly Operational Plan (YOP) as approved by the Department. Such documents shall be available at the work site at all times during herbicide applications and be made available to the Department and municipal officials including the Conservation Commission and Board of Health upon reasonable request.

(3) No person shall handle, mix or load an herbicide concentrate on a right-of-way within 100 ft. of a sensitive area.

(4) The perimeter of any sensitive areas which are not readily identifiable on the ROW shall be appropriately marked prior to any herbicide applications. The precise method used in marking these areas shall be identified in the VMP.

(5) No foliar application of herbicides shall be used to control vegetation greater than 12 ft. in height except for side trimming.

(6) No herbicide shall be applied when the wind velocity is such that there is a high propensity to drift off target and/or during measurable precipitation.

(7) No person shall apply herbicides by aircraft for the purpose of clearing or maintaining a right-of-way.

(8) No touch-up applications shall be carried out except under the following conditions:

(a) Touch-up applications must occur within 12 months of the date of approval of the YOP.

(b) The Department, the Conservation Commission, the Board of Health, and Chief elected official of the municipality shall be notified by certified mail at least 21 days prior to any application.

(c) No more than 10% of the initially identified target vegetation on the applicant's right-of-way in any municipality may be treated and the total amount of herbicide applied in any one year shall not exceed the limits specified by the label or Yearly Operational Plan.

(d) The Department may impose such additional restrictions or conditions on the use of herbicides as it deems necessary to protect public health and the environment.

(9) The Department will maintain mailing lists of individuals and groups desiring to obtain notices on various aspects of the Program.

11.04: Sensitive Area Restrictions

(1) General

(a) No more than the minimum labelled rate of the pesticide product for the appropriate site, pest, and application method shall be applied.

(b) Herbicides applied in sensitive areas shall be applied selectively by low pressure foliar techniques or stem application.

(c) No person shall apply herbicides for the purpose of clearing or maintaining a right-of-way in such a manner that results in drift to any area within 10 feet of standing or flowing water in a wetland or area within 400 feet of a public drinking water supply well; or area within 100 feet of any surface water used as a public water supply; or area within 50 feet of a private drinking water supply identified in accordance with 333 CMR 11.04(2)(c)(3).

(d) The Department, in cooperation with the Department of Environmental Protection, and subject to a Memorandum of Understanding will evaluate herbicides currently registered for use on rights-of-way and will distribute a list of herbicides recommended for use in sensitive areas and guidelines for their use. The Memorandum of Understanding will set forth a procedure for this evaluation based on all available data relative to environmental fate and toxicity. Such list, guidelines and procedures will be subject to review and comment by the Department of Public Health provided that such comments are provided to the Department within a reasonable time. The Department, on August 15 of the calendar year, will make available the list and guidelines to applicants and to the VMP Advisory Committee. Applicants proposing to use an herbicide which has been registered for use on rights-of-way but has not yet been evaluated pursuant to the provisions of the Memorandum of Understanding may request that such herbicides be evaluated pursuant to said provisions. For an herbicide which has been evaluated pursuant to the provisions of the Memorandum of Understanding, applicants proposing to use such herbicide in a manner inconsistent with the terms and conditions of use imposed in the guidelines may request a modification or waiver of such terms or conditions. A request for such modification or waiver shall provide a detailed rationale for use, including all relevant data including but not limited to environmental fate, efficacy and human health effects of the proposed herbicide. Such herbicides and/or uses shall be subject to the evaluation standards adopted by the Departments of Food and Agriculture and Environmental Protection in the Memorandum of Understanding.

Commentary

Applicants subject to the provisions of the Wetlands Protection Act, who wish to apply pesticides registered for use in Massachusetts to rights-of-way, may choose to apply herbicides determined to be suitable for use in sensitive areas in accordance with the provisions of the Memorandum of Understanding mentioned above or, alternatively, applicants may proceed pursuant to the provisions of 310 CMR 10.00 as authorized by M.G.L. c. 131, s. 40.

(e) The Department may impose such additional restrictions or conditions on the use of herbicides within or adjacent to sensitive areas as it determines necessary to protect human health or the environment. Such changes may be proposed by a municipal agency or individual during the public comment period.

(2) Water Supplies

(a) Public Ground Water Supplies

1. No herbicides shall be applied within 400 feet of any public ground water supply well.

2. No herbicides shall be applied within the primary recharge area of a public ground water supply well except under the following conditions:

a. A minimum of 24 months shall elapse between applications; and

b. Herbicides shall be applied selectively by stem application or low pressure foliar techniques.

(b) Public Surface Water Supplies

1. No herbicide shall be applied within 100 feet of any surface water used as a public water supply.

2. No herbicide shall be applied between 100 feet and 400 feet of any surface water used as a public water supply except under the following conditions:

a. A minimum of 24 months shall elapse between applications: and
b. Herbicides shall be applied selectively by low pressure foliar techniques or stem application.

(c) Private Drinking Water Supplies

1. No herbicide shall be applied on or within 50 feet of any private drinking water supply identified in accordance with 333 CMR 11.04(2)(c)(3).

2. No herbicide shall be applied between 50 feet and 100 feet of any private drinking water supply identified in accordance with 333 CMR 11.04(2)(c)(3) except under the following conditions:

a. A minimum of 24 months shall elapse between applications: and
b. Herbicides shall be applied selectively by low pressure foliar techniques or stem application.

3. It shall be the responsibility of the applicant to adhere to the sensitive area restrictions around identified private wells. The applicant shall consult with the Department to identify private wells that are located within 100 feet of the rights-of-way. The Department shall request the location of private wells along the right-of-way from the Department of Environmental Management and local Boards of Health. Wells identified to be within 100 feet shall be kept on file by the applicant for delineation on the maps in the YOP and be listed in the YOP. The VMP must include the method of locating identified private wells in the field prior to the application of herbicides.

(3) Surface Waters

(a) No herbicide shall be applied on or within ten feet of any standing or flowing surface water which is not a public water supply. No herbicides shall be applied between ten feet and 100 feet of any standing or flowing surface water which is not a public water supply except under the following conditions:

1. A minimum of 12 months shall elapse between application: and
2. Herbicides shall be applied selectively by low pressure foliar techniques or stem application.

(4) Wetlands

(a) No herbicide shall be applied on or within ten feet of a wetland.

(b) No herbicide shall be applied between ten feet and 100 feet of a wetland except under the following conditions:

1. A minimum of 12 months shall elapse between applications: and
2. Herbicides shall be applied selectively by low pressure foliar techniques or stem application.

(c) Notwithstanding 333 CMR 11.04(4)(a), public utilities providing electric, gas, water, telephone, telegraph and other telecommunication services may apply herbicides on or within ten feet of a wetland in accordance with the following conditions:

1. Submission of a study, the design of which is subject to prior approval by the Departments of Food and Agriculture and Environmental Protection, evaluating impacts of proposed vegetation management programs on wetlands: and
2. A finding by the Department, after consultation with the Advisory Committee, that the proposed vegetation management program will result in less impacts to the wetland than mechanical control.
3. Notwithstanding the above, no herbicides shall be applied on or within ten feet of any standing or flowing water in a wetland.

(5) Inhabited and Agricultural Areas

(a) No high pressure foliar herbicide applications shall be carried out within 100 feet of any inhabited area or any agricultural area during the growing season.

(b) No foliar herbicide shall be applied within 100 feet of any inhabited area or any agricultural area during the growing season except under the following conditions:

1. A minimum of 12 months shall elapse between applications: and
2. Herbicides shall be applied selectively by low pressure foliar techniques or stem application.

11.05: Vegetation Management Plan (VMP)

(1) General

(a) Unless otherwise specified by the Department, all VMPs should be submitted by the applicant no later than September 1 prior to the calendar year of the proposed first year of maintenance. All approved VMPs shall take effect on January 1 unless otherwise specified by the Department, and shall be effective for a five year period unless otherwise modified, or revoked by the Department.

(b) The VMP shall be presented on forms and/or format approved by the Department.

(2) Requirements. The VMP shall include but not be limited to the following:

(a) General statement of goals and objectives of the VMP.

(b) Identification of target vegetation.

(c) Intended methods of vegetation management and rationale for use, including vegetation control techniques, equipment proposed for use and timing of applications and alternative control procedures.

(d) Justification of herbicide applications proposed.

(e) Methods, references and sources for identifying sensitive areas and control strategies proposed for sensitive areas.

(f) Operational guidelines for applicators relative to herbicide use.

(g) Identification and qualifications of individuals developing and submitting a plan.

(h) A description of Integrated Pest Management Programs or other techniques/programs to minimize the amount and frequency of herbicide application.

(i) Description of alternative land use provisions or agreements that may be established with individuals, state, federal or municipal agencies that would minimize the need for herbicide, including the rationale for accepting or denying any reasonable request made by any individual.

(j) Remedial plan to address spills and related accidents.

(3) Public Notice, Review and Comment

(a) Upon receipt of the proposed VMP, the Department shall schedule and hold appropriate regional public hearings affording all interested parties the opportunity to comment on the proposed plan.

(b) At least 21 days prior to the public hearings, the Department shall publish notice of the hearings in the Environmental Monitor and regionally located newspapers, and send notice to municipalities covered by the plan and to the appropriate mailing list. The notice will include locations where copies of the VMP can be reviewed.

(c) The public shall have no less than 45 days, starting from publication of the Environmental Monitor notice, to comment upon proposed VMPs, unless the Department extends the comment period for good cause.

(d) At least 21 days prior to the end of the public comment period, the applicant shall send a copy of the proposed VMP to the chief elected official, the Board of Health and the Conservation Commission in affected communities upon their request.

(4) VMP Advisory Panel

(a) There shall be a VMP Advisory Panel charged with the responsibility of reviewing Vegetation Management Plans and the accompanying public comments. The Panel shall recommend approval, denial or modification to the Department.

(b) The Panel shall consist of the Commissioner(s) or designees of the following Departments:

Department of Food and Agriculture, non-voting
Department of Environmental Protection
Department of Public Health
Department of Public Works and
Division of Fisheries and Wildlife, Natural Heritage Program
a representative appointed by the Commissioner of
DFA from each of the following groups:
Massachusetts Association of Conservation
Commissions:

Massachusetts Association of Health Boards:
University of Massachusetts/Extension Service:
railroads:
utilities:
applicator; and an
environmentalist

A member shall be appointed for a term of one, two or three years. Appointed members shall serve at the discretion of the Commissioner. No member shall serve more than six consecutive years. Appointed panel members shall serve without compensation and shall not be reimbursed for any expenses incurred by them in the performance of their duties. The Commissioner of the Department or designee shall serve as an ex officio non-voting member to the VMP Advisory Panel.

(c) The Department of Food and Agriculture's Representative shall chair the VMP Advisory Panel. This chairperson shall coordinate efforts of the Department and the Panel to process the VMPs.

(d) The VMP Advisory Panel shall conduct business in accordance with the time, place and procedures agreed upon.

(e) The VMP Advisory Panel shall review all complete VMPs including all written and public hearing comments. The Advisory Panel may, if necessary, request from the applicant additional information. Within 30 days of the end of the comment and review period, unless extended for good cause, the VMP Advisory Panel shall recommend to the Department in writing approval, denial or modification of each VMP.

(5) Disposition of VMP

(a) 30 copies of the proposed VMP shall be submitted to the Department. The Department shall distribute copies of the proposed VMP to each member of the Advisory Panel.

(b) Within 30 days of the end of the public comment period unless extended for good cause, the VMP Advisory Panel shall review the VMPs and recommend in writing to the Department approval, denial or modification of each VMP; if necessary, the Panel may request from the applicant additional information.

(c) Within 21 days of the end of the VMP Advisory Panel review period, unless extended by the Department for good cause, the Department will notify the applicant and the Advisory Panel in writing one of the following:

1. request for additional information or modification; or
2. denial of VMP; or
3. approval of VMP.

(d) The VMP may be modified, withdrawn or amended by the applicant through a written request sent by certified mail to the Department.

(e) Resubmission of a denied VMP, updating of a VMP, or a significant amendment to an approved VMP shall be processed according to 333 CMR 11.05.

(f) The applicant must send a copy of the approved VMP to the chief elected official, Board of Health, and Conservation Commission in each municipality covered by the plan.

(6) Time for Action. Non action on a Vegetation Management Plan within time specified herein does not constitute approval of the submitted plan. In the event that the Department fails to notify the applicant of a decision within the time specified above and upon written request from the applicant, the Commissioner must issue a finding within ten days of receipt stating the reason for the delay and providing an estimated completion date.

11.06: Yearly Operational Plan (YOP)

(1) General

(a) The applicant is responsible for the accuracy and completeness of all information submitted with the YOP. The YOP shall be consistent with the objectives of the VMP and shall describe the intended operational program for that calendar year.

(b) The YOP shall be presented on forms and/or format approved by the Department.

(2) Requirements. The YOP shall include but not be limited to the following:
(a) Maps locating the ROW and Sensitive areas not readily identifiable in the field.
(b) Herbicides proposed including application rates, carriers, adjuvants.
(c) Herbicide application techniques and alternative control procedures proposed.
(d) The company which will perform any herbicide treatment.
(e) Identification of target vegetation.
(f) Individual representing applicant supervising YOP.
(g) Flagging methods to designate sensitive areas on the ROW.
(h) Herbicide Fact Sheets as approved by the Department.
(i) Procedures and locations for handling, mixing and loading of herbicide concentrates.

(3) Public Notice, Review and Comment
(a) Upon submittal of the YOP for approval, the Department will publish a notice in the Environmental Monitor. Said notice shall be provided by the applicant and shall include the information on the municipalities through which the rights-of-way pass, a brief description of the intended program, and the procedure for public review and comment. The Department will distribute copies of the Environmental Monitor notice to the appropriate mailing list and the applicant.
(b) The applicant shall provide by certified mail under separate cover to the Board of Health, Conservation Commission and chief elected municipal official a copy of the proposed YOP and the Environmental Monitor notice for the city or town in which the herbicide treatment is proposed. The applicant shall maintain copies of the packet sent to municipalities and certified mail receipts as part of the recordkeeping requirements. 333 CMR 10.15.
(c) The Department shall allow a 45 day comment period on proposed YOPs, unless extended for good cause, commencing with the publication of the notice in the Environmental Monitor and receipt of the proposed YOP and Environmental Monitor notice by each municipality.
(d) The Department may approve, deny or modify YOPs after the 45 day comment period has expired.

(4) Disposition of YOP
(a) The YOP shall be submitted by the applicant to the Department at least 90 days prior to the proposed commencement of application to allow completion of the comment period and review.
(b) The Department shall review the YOP to ensure that the YOP is consistent with the approved VMP. Any inconsistencies or deficiencies will be noted by the Department and returned to the applicant.
(c) Where practical, the Department shall approve or deny the YOP within 90 days of receipt. The Department will provide notice of the decision to the applicant, municipal agencies and commentators in writing.
(d) The approved YOP in conjunction with the VMP shall govern the application of herbicide for a period not to exceed 12 months in accordance with other laws and regulations of the State and Federal governments and impose such conditions as necessary to minimize the risk of adverse effects on human health and the environment.

(5) Time for Action. Non action on a Yearly Operational Plan within the time specified herein does not constitute constructive approval of the submitted plan. In the event that the Department fails to notify the applicant of a decision within the time specified above and upon a written request from the applicant the Commissioner must issue a finding within 10 days of receipt stating the reason for the delay and providing an estimated completion date.

11.07: Public Notification

The applicant shall provide by certified mail under separate cover, at least 21 days in advance of the application of herbicide to the right-of-way, a notice to the Department and to the Mayor, City Manager or Chairman of the Board of Selectman, the Board of Health, and the Conservation Commission in the

municipality where the right-of-way lies. The notice shall include but not be limited to the approximate date on which such spraying shall occur, provided however, that said spraying shall not conclude more than ten days after said approximate date; a copy of a DFA approved Herbicide Fact Sheet on the active ingredient(s) of the herbicide(s) used; the name and address of contractor who will make the application or the name of the certified employee who will make the application.

This notice may run concurrently with the public notice and comment period in 333 CMR 11.06(3) provided the application is made after the close of the public notice and comment period and all modifications to the YOP are made before the application takes place and approval is granted by the Department.

11.08: Notice of Modification and Revocation

(1) The Department may suspend approval of any VMP or YOP, by written notice to the applicant and applicator, halting the application of herbicide to that right-of-way of the above mentioned YOP. After 21 days if the applicant does not request a hearing, the Department may revoke or modify the VMP and YOP, if it finds:

(a) that the terms, conditions of restrictions thereof, are being violated or are inadequate to avoid unreasonable adverse effects on the environment or on human health; or

(b) that the applicant has made a false or misleading statement in the VMP or YOP; or

(c) that the applicant has violated any provision of the Massachusetts Pesticide Control Act or FIFRA, or any regulations, standards, orders or license issued under either.

(2) Upon notice of revocation or modification, the applicant may modify the YOP by written request to the Department. Applications to modify the YOP shall be submitted in the manner set forth in 333 CMR 11.06 and disposed of in the manner set forth in 333 CMR 11.06. The Department may waive all or part of the requirement if it determines that the proposed changes do not significantly change the terms of the approved YOP.

11.09: Rights of Appeal

Any person aggrieved by the decision of the Department to approve, deny, modify or revoke a Vegetation Management Plan or a Yearly Operational Plan may request an adjudicatory hearing. The request for a hearing must be sent to the Department by Certified mail or hand delivered within 21 days after the date of decision or notice by the Department. At the same time the request for a hearing must be sent by Certified mail or hand delivered to the applicant and the Pesticide Board. The request should state clearly and concisely the facts of the proceeding, the reasons the decision is alleged to be inconsistent with 333 CMR 11.00 and the relief sought by the adjudicatory hearing. The adjudicatory hearing before the Pesticide Board shall be conducted as set forth in M.G.L. c. 30A and M.G.L. c. 132B, s. 13.

11.10: Penalties

Any person who violates any provision of 333 CMR 11.00 shall be subject to the criminal and civil penalties set forth in M.G.L. c. 132B, s. 14.

REGULATORY AUTHORITY

333 CMR 11.00: M.G.L. c. 132B.

APPENDIX C

310 CMR

Preface to Wetlands Regulations
Relative to Right-of-Way Management.

PREFACE TO WETLANDS REGULATIONS RELATIVE TO RIGHTS OF WAY MANAGEMENT

1987 REGULATORY REVISION

In 1983, the Massachusetts Pesticide Control Act, Ch. 132B, was amended to require notification of conservation commissions prior to application of herbicides on rights of way. Many commissions became aware for the first time that application of herbicides on rights of way may result in alteration of wetlands and, with the exception of exempt utilities, may require action under the Wetlands Protection Act. On July 18, 1986, the Department issued a final decision after adjudicatory hearing in DEQE Hearing Docket Nos. 83-28 and 83-35 (Clinton and Leverett) finding that the application of specific herbicides by the railroads to track and ballast within 100 feet of wetland areas would alter those wetlands and was therefore subject to jurisdiction under the Act, requiring the filing of Notices of Intent with the local conservation commissions.

The Department of Food and Agriculture (DFA) initiated a Generic Environmental Impact Report (GEIR) evaluating alternatives for rights of way management. A technical advisory task force of environmentalists, agencies and rights of way managers assisted in the GEIR preparation and, based on results of the study, recommended to the Secretary of Environmental Affairs a framework for a coherent state-wide rights of way regulatory program. DFA published draft regulations to implement this program in 1986 and received extensive public commentary. Final regulations, 333 CMR 11.00, became effective on July 10, 1987.

The DFA regulations require persons proposing to apply herbicides to rights of way to first receive approval of a five year Vegetation Management Plan (VMP) and Yearly Operating Plan (YOP). These regulations identify certain "sensitive areas", including wetlands and public and private surface and groundwater supplies, where the application of herbicides is, in most instances, prohibited, and areas adjacent to the sensitive areas where use of herbicides is curtailed.

DEQE worked closely with DFA to include provisions which give maximum protection for water supplies and provide protection for wetlands at least equal to that provided under the Wetlands Protection Act and regulations. To eliminate duplicate review under the Wetlands Protection Act, DEQE has adopted changes to the wetlands regulations which allow herbicide applications on rights of way in accordance with the DFA regulations without filing a Notice of Intent under the Wetlands Protection Act. However, non-exempt applicants will still be required to file a Request for Determination of Applicability to the appropriate conservation commission to establish boundaries of wetlands on or near the right of way. Specifically, these regulations presume that work performed in accordance with a VMP and YOP, as may be required under DFA regulations, will not alter an area subject to protection under the Wetlands Protection Act.

During the public comment period on its proposed regulations, the Department identified several issues of major concern. After consideration of all comments, the Department has determined that, except for minor points of clarification and the addition of an automatic expiration date, no further changes in the regulations are warranted at this time. A discussion of these issues follows.

A. Presumption vs. Limited Project. Several commentators suggested that conservation commissions should retain the authority to review each herbicide application on rights of way through the usual Notice of Intent process. These regulations create a presumption that herbicide application carried out in accordance with an approved VMP and YOP under the DFA regulations will not alter wetlands and that the filing of a Notice of Intent is therefore not required. This procedure was established pursuant to the recommendation of the GEIR task force which states:

10.00: continued

> The regulations which provide for approval of Vegetation Management Plans by the Department of Food and Agriculture should be conditioned on review and approval by the Department of Environmental Quality Engineering (DEQE) of those portions of the Plans that deal with wetlands. The DEQE should be required to certify to the DFA that these portions of the Plans will result in compliance with the substantive and procedural provisions which protect the interests of the Wetlands Protection Act. If the regulations are so drawn, activities under a Plan approved by DEQE would not constitute an alteration of wetlands as defined under the Wetlands Protection Act regulations.

Since the DFA regulations provide that DEQE is a member of the VMP advisory panel which reviews and makes recommendations on the approval of VMPs, the GEIR task force recommendations have been fully implemented. Therefore, the Department has determined that it would be duplicative to require the filing of individual Notices of Intent in each municipality for each application of herbicides to rights of way.

B. Adequacy of Setback from Wetlands. The DFA rights of way regulations prohibit application of herbicides on or within ten feet of wetlands and strictly limit herbicide application from ten feet to 100 feet of wetlands. Many commentators questioned the adequacy of these setback requirements and suggested that a 50 or 100 foot no spray zone would be more appropriate. Several commentators suggested that the proposed setback requirements were inconsistent with the Department's adjudicatory hearing decision in the Clinton and Leverett cases.

The no spray zone surrounding wetlands is necessary for three reasons: to compensate for mapping errors, to compensate for applicator errors and to assure that herbicides will not migrate into wetlands after application on the adjacent uplands. During the public comment period, the Department received no evidence demonstrating that the ten-foot setback established in the DFA regulations will not be adequate. The DFA regulations establish a procedure for selecting a limited number of herbicides that may be applied in the limited spray zone (from 10 to 100 feet from wetlands) which is adjacent to the no spray zone. Herbicides that will be selected for use in these limited spray zones under the DFA regulations are those which available data demonstrate will not migrate further than ten feet.

The applicators have argued that they can maintain a level of accuracy in mapping of wetlands and in application of herbicides to assure that herbicides will not be inadvertently applied within ten feet of wetland areas. The Department is not convinced that these claims are unreasonable; however, in order to confirm their accuracy, the Department has included in the final regulations an automatic expiration date two years from the effective date, which is coterminous with the expiration date of the DFA regulations. During the two-year effective period of these regulations, the Department expects applicators to conduct studies monitoring herbicide application operations and to submit a report concerning impacts of herbicide application on wetlands under these new regulations detailing the accuracy of wetlands mapping, the accuracy of herbicide application, and the extent of herbicide migration. The results of this study will provide a basis for recommendations by the Department for amendments to the DFA regulations and a decision on reauthorization of these amendments to the Department's wetland regulations.

Finally, the Department does not find the setbacks requirements established in the DFA regulations to be inconsistent with its decision in the Clinton and Leverett cases. In that decision, the Department assumed a worst-case analysis in terms of an herbicide known to be highly mobile which was applied to the track and ballast areas adjacent to wetlands. The Department found, based on the particular facts of these cases and the particular herbicide

10.00: continued

proposed for application that there would be a migration of that herbicide into the wetlands from application within the 100-foot buffer zone that would be sufficiently concentrated to cause alterations of the wetlands plants. However, the DFA rights of way management regulations set up a procedure for identification of herbicides which are relatively immobile and which are preapproved for application on the buffer zone in order to avoid alteration of wetlands plants. Furthermore, guidelines for application of the selected herbicides will also be established. Finally, no herbicides may be applied within ten feet of wetland areas. In light of the strict controls placed on application of herbicides within the 100-foot buffer zone under the DFA regulations, the Department finds that adoptions of the proposed regulatory scheme is fully consistent with its previous adjudicatory hearing decision in the Clinton and Leverett cases.

C. Impacts of Herbicides Application on Wildlife Habitat. The Department is currently developing regulations under the Act to protect wildlife habitat. The effective date of these regulations is November 1, 1987. One commentator expressed concern regarding the impact of herbicide application on wildlife habitat in wetlands, and particularly on the habitat of rare, "state-listed" wildlife species. As discussed above, the Department has determined that the DFA regulations provide for protection of wetlands from alterations due to herbicide application. However, the DFA regulations do not include floodplains in their definition of wetlands, although those regulations do prohibit herbicide application within 10 feet of any standing or flowing surface water. Beyond that, there is no specific protection of wildlife habitat, including rare species, in floodplain areas.

The Department is concerned that the DFA regulations do not specifically address protection of wildlife habitat in floodplains, in particular those rare, "state-listed" wildlife species. Therefore, as a member of the VMP advisory panel, the Department will review VMPs for potential effect on wildlife habitat and specifically will recommend disapproval of any VMP that will have an adverse effect in areas mapped by the Natural Heritage and Endangered Species Program as habitat of any rare, "state-listed" wildlife species. Furthermore, the Department expects applicators to incorporate into the previously discussed two-year monitoring study a section detailing the effects of herbicide application on wildlife habitat in floodplains and on the habitat of rare, "state-listed" wildlife species. The Department will use the results of this study as the basis for recommending any amendments to the DFA regulations and a decision on reauthorization of these amendments to the Department's wetlands regulations.

APPENDIX D

Herbicides aproved for use on
sensitive areas of railroad ROW's
as of 1 January 1995.

The following is the "LIST" of recommended herbicides for use in sensitive areas within Rights-of-Way pursuant to 333 CMR 11.04(1)(d).

Trade Name	EPA Reg. No.	Active Ingredient	Use Restrictions
Accord	524-326	Glyphosate	None
Rodeo	524-343	Glyphosate	None
Roundup	524-308	Glyphosate	None
Arsenal	241-273	Imazapyr	3 Pints/acre Every 3rd Year or 2 Pints Every Other Year
Chopper RTU	241-330	Imazapyr	None
Arsenal NS	241-346	Imazapyr	3 Pints/acre Every 3rd Year or 2 Pints Every Other Year
Krenite	352-376	Fosamine Ammonium	None
Krenite S	352-395	Fosamine Ammonium	None
Krenite UT	352-395	Fosamine Ammonium	None
Escort	352-439	Metsulfuron Methyl	None
Banvel CST	55947-32	Dicamba	Sponge Application to Cut Stump
Garlon 4	464-554	Triclopyr (Butoxy ethyl ester)	0.5 Pints/acre within 10 feet; 3.0 pints/acre within 50 feet

Applications of herbicides for the purpose of railroad Rights-of-Way maintenance which are not recommended above are subject to the provisions of MGL c.131 Section 40, and MGL c.21A Section 2, and regulations promulgated thereunder.

Yearly Operational Plan

1995

CONSOLIDATED RAIL CORPORATION

2001 Market Street 10B
P.O. Box 41410
Philadelphia, Pennsylvania 19101-1410

Prepared by:

TEC Associates
169 Front Street
South Portland, Maine 04106

ABSTRACT:

This Yearly Operational Plan (YOP) describes the vegetation management operations for the Railroad's rights-of-way (ROW) scheduled for vegetation maintenance during this calendar year in compliance with the Commonwealth of Massachusetts ROW Management Regulations 333 CMR 11.00.

This YOP is a companion document to the Vegetation Management Plan (VMP) which has been approved by the Department of Food and Agriculture.

INTRODUCTION

Both Federal and State laws require railroads to manage vegetation to help insure the safe passage of people, material, and goods.

The Code of Federal Regulations mandates the safety of the railroad must be guaranteed by regular inspection and maintenance. Vegetation must be controlled so that it does not become a fire hazard, does not interfere with visibility, or impede direct visual inspections of the track structure. Vegetation must also be managed to allow for proper drainage of the track and ballast structure, to prevent tree and branch damage to cargo and to provide safe footing and working conditions for trackside personnel. Vegetation growing along side the rails can prevent effective and adequate braking, especially in emergency situations.

The purpose of 333 CMR 11.00, Rights of Way Management, is to promote the implementation of Integrated Pest management techniques and to establish standards, requirements, and procedures necessary to minimize the risk of unreasonable adverse effects on human health and the environment associated with the use of herbicides to maintain rights-of-way. These regulations establish procedures which guarantee ample opportunity for public and municipal agency review and input on right-of-way maintenance plans.

A Yearly Operational Plan or YOP must be submitted to the Department of Food and Agriculture every year herbicides are intended for use to maintain Rights of Way. The YOP provides a detailed program for vegetation management for the year. This YOP is a companion document to the Vegetation Management Plan (VMP) approved by the Department. The VMP is the long term management plan for the railroad which describes the intended program for vegetation control over a five year period.

Upon receipt of this YOP, the Department publishes a notice in the Environmental Monitor. The applicant has provided a copy of the YOP and Environmental Monitor notice to the Board of Health, Conservation Commission and the chief elected municipal official for the city or town in which the herbicide treatment is proposed.

The Department allows a 45 day comment period on the proposed YOP beginning with publication of the notice in the Environmental Monitor and receipt of the YOP and Environmental Monitor notice by each municipality.

Public notification of herbicide application to the right of way is made by certified mail under separate cover at least 21 days in advance of the treatment. Notice is made to the Department of Food and Agriculture; the Mayor, City Manager or chairman of the Board of Selectman; the Board of Health; and the Conservation Commission of the municipality where the right-of-way lies.

Any comments on this YOP should be directed to the railroad contact person listed on page 1.

MUNICIPALITIES WHERE TREATMENT DESCRIBED IN THIS YOP WILL BE MADE.

Ashland	Framingham	Quincy
Attleborough	Freetown	Randolph
Auburn	Grafton	Rayham
Avon	Hinsdale	Richmond
Becket	Holbrook	Russell
Berkley	Holliston	Seekonk
Berlin	Huntington	Sherborn
Bolton	Lakeville	Somerville
Boston	Lancaster	Southborough
Braintree	Leicester	Spencer
Bridgewater	Leominster	Springfield
Brimfield	Mansfield	Sterling
Brockton	Marlborough	Sudbury
Brookfield	Medfield	Taunton
Brookline	Middleborough	W. Bridgewater
Cambridge	Middlefield	W. Brookfield
Charlton	Millbury	W. Springfield
Chester	Monson	W. Stockbridge
Clinton	Montgomery	Walpole
Dalton	Natick	Warren
Dartmouth	New Bedford	Washington
Dedham	Newton	Wellesley
E. Bridgewater	Northborugh	Westborough
E. Brookfield	Norton	Westfield
Everett	Norwood	Weston
Fall River	Oxford	Westwood
Fitchburg	Palmer	Wilbraham
Foxborugh	Pittsfield	Worcester

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APPENDICES

A. Herbicide Fact Sheets as approved by the Department of Food and Agriculture

B. Maps locating the ROW and Sensitive areas not readily identifiable in the field

I. THE COMPANY WHICH WILL PERFORM ANY HERBICIDE TREATMENT

This company or contractor will perform the herbicide treatment. Applicators are certified by the Department of Food and Agriculture in the applicator category Right of Way Pest Control.

Company Name DeAngelo Brothers, Inc.

Address 5 North Conahan Drive
Butler Industrial Park
Hazleton, PA 18201

Telephone # 717/459-5800

Contact Person(s) Neal DeAngelo

II. INDIVIDUAL REPRESENTING APPLICANT AND SÚPERVISING THE YOP

Individual supervising execution of the YOP and representing the railroad.

Name and Title Frank DeVilbiss, Engineer-Vegetation Control

Address Consolidated Rail Corporation
2001 Market Street - 10B
P.O. Box 41410
Philadelphia, PA 19101-1410

Phone Number 215/209-5795

III. HERBICIDES PROPOSED INCLUDING APPLICATION RATES, CARRIERS, ADJUVANTS, AND APPLICATION TECHNIQUES

Weed Control Herbicide Program for the Roadbed

The post-emergent herbicide program is aimed primarily toward keeping the ballast section and shoulder, yards, switches, signals, and highway grade crossings weed free. Areas scheduled for weed control treatments have been inspected for density of target vegetation to determine appropriate control methods. Herbicide Fact Sheets for the herbicides proposed are found in Appendix A.

Location	Herbicide(s)	Carriers or Adjuvants	Application Technique	Application Rate
Non-sensitive yard areas; pre-emergent	Karmex Oust	More	Pre-emergent Pre-emergent Pre-emergent	5 lbs/ acre 4oz/ acre 2-4 oz/ acre
Sensitive and non-sensitive ROW areas	Roundup Arsenal	More	Foliar Foliar Foliar	2 qts/ acre 1 qt/ acre 2-4 oz/ acre
Non-sensitive yard areas; post-emergent	Roundup Arsenal	More	Foliar Foliar Foliar	2 qts/ acre 1 qt/ acre 2-4 oz/ acre
Touch-up applications	Roundup	More	Foliar Foliar	3 qts/ acre 2-4 oz/acre

Brush Control Program For Areas Adjacent To The Roadbed

The brush control program is designed to prevent the regrowth of trees and other woody vegetation in areas adjacent to the roadbed. Areas scheduled for brush control treatments are limited to target vegetation which obscures visibility or interferes with railroad signs, signals, or communication wires. Herbicide Fact Sheets for herbicides proposed may be found in Appendix A.

Location	Herbicide(s)	Carriers or Adjuvants	Application Technique	Application Rate
Non-sensitive areas	Roundup Arsenal	Exact-trol	Foliar Foliar Foliar	4 qts/ acre 6 oz/ acre 4 oz/ acre
Touch-up applications	Roundup	More	Foliar Foliar	3 qts/ acre 2-4 oz/ acre

IV. HERBICIDE APPLICATION TECHNIQUES AND ALTERNATIVE CONTROL PROCEDURES

Herbicide application within the Railroad ROW will be preformed using low pressure application from a specialized high rail track equipped with a spray boom. This method is suitable for application within the buffer zone, or restricted application zone, of sensitive areas, as defined in 333 CMR 11.04. The spray vehicle is equipped with spray nozzles and controls to allow for treatment of the entire roadbed, or to selectively treat individual sections of the ballast and ballast shoulders. Within sensitive areas, a "container" will be used to catch any accidental dripping of herbicide. It is a trough-shaped apparatus mounted just behind and above the boom, and will be hydraulically lowered to sit underneath the spray nozzles while the vehicle is traveling through areas where herbicide spraying is prohibited.

In order to assist in rapid identification of sensitive areas in the field, a pilot vehicle will proceed approximately 1/4 mile ahead of the applicator vehicle in order to signal ahead the location of sensitive areas.

In order to provide greater mobility and decrease the amount of time required to apply the herbicide mixture in the railroad yard areas, a vehicle equipped with hoses will be used in these areas. In compliance with the Regulations for herbicide application in Sensitive Areas, the spray pressure from the hoses will not exceed 60 psi.

ALTERNATIVE CONTROL PROCEDURES

No alternative vegetation control methods are feasible within the track areas of the ROW. No vegetation control is proposed in ballast areas where herbicide use is prohibited. Areas not treated or prohibited from herbicide application will be maintained mechanically and manually.

Touch-up techniques controls any target vegetation within the ballast that may have been missed or not treated during the initial phase. Control of vines and other vegetation that might creep onto the ballast from roots growing outside the original treatment boundaries can be managed as a selective, foliage, or spot spray. No more than 10% of the initially identified target vegetation on the ROW in any municipality may be treated during a touch-up application and the total amount of herbicide applied in any one year shall not exceed the limits specified by the label of YOP [per 11.03(8)(C)].

V. IDENTIFICATION OF TARGET VEGETATION

Whenever and wherever possible an integrated approach to vegetation management will be implemented by encouraging plant communities that hinder the growth of target vegetation. Prior to a herbicide application, a review will be made noting location, density, and type of vegetation present. This information will be used to develop a herbicide application program that will be effective against target vegetation and minimize the amount of herbicide used.

All vegetation growing in the ballast and ballast shoulder; in yards; and around switches, signals, signs and highway grade crossings is considered target vegetation and must be controlled so that it does not:

a) become a fire hazard to track-carry structures;
b) obstruct visibility of railroad signs and signals;
c) interfere with railroad employees preforming normal trackside duties;
d) prevent proper functioning of signal and communication lines; and
e) prevent railroad employees from visually inspecting moving equipment from their normal duty stations.

Woody vegetation growing in areas adjacent to the shoulder will be managed to promote the growth of low growing shrubs. Targeted woody vegetation will be that which has the potential to block visibility or invade the roadbed and/or overhead communication lines. Target vegetation will include but not be limited to the following:

Ailantus	Black Walnut	Honey Locust
American Basswood	Buckthorn	Maple
American Beech	Butternut	Northern Catalpa
American Hornbeam	Cherry	Oak
Apple	Eastern Horphornbeam	Pine
Ash	Eastern Redcedar	Poplar
Aspen	Elm	Sassafras
Birch	Flowering Dogwood	Shadbrush
Black Locust	Hawthorn	Spruce
Black Tupelo	Hickory	Sumac

VI. FLAGGING METHODS TO DESIGNATE SENSITIVE AREAS ON THE ROW

Sensitive areas are defined in the Rights-Of-Way Management Regulations(333 CMR 11.02) as those areas within the ROW in which public health, environmental, or agricultural concerns warrant special protection to further minimize risks of unreasonable adverse effects. These include but are not limited to the following:

- Within the primary recharge area of a public drinking water supply well.
- Within 400 feet of any surface water used as a public water supply.
- Within 100 feet of any identified private drinking water supply.
- Within 100 feet of any standing or flowing water.
- Within 100 feet of any inhabited or agricultural area.
- Within 100 feet of any wetlands.

No-spray areas are those in which herbicide spraying is prohibited. It includes track within 400 feet of a public water supply wellhead, 100 feet from a public surface water supply, a 50 foot radius around a private well, and 10 feet from the edge of standing or flowing water or wetlands.

Limited-spray areas are those in which spraying is restricted to one annual application of an herbicide through low pressure foliar techniques. This includes track between 10 and 100 feet from the edge of standing or flowing water or wetlands. Lengths of track within the primary recharge area around a public water supply wellhead, between 100-400 feet from the edge of a public surface water supply, and between 50 and 100 foot radius around a public well, spraying is restricted to one application every other year of an herbicide through low pressure foliar techniques.

Non-sensitive areas which are upland areas and/or lengths of track without proximate sensitive areas do not require specific precautions or herbicide restrictions.

Sensitive areas, no-spray areas, limited-spray areas and non-sensitive areas will be marked at their boundaries with permanent color-coded markers. Sensitive areas considered to be readily identifiable in the field (i.e. agricultural and inhabited ares) will not be marked. The markers will be one or any combination of the following:

- color-coded signs attached to posts
- color-coded signs attached to the railroad ties
- color-coded painted rail sections

Sensitive and non-sensitive areas will be designated by the following color-codes:

- white non-sensitive areas
- blue sensitive area in which a minimum of 12 months shall elapse between herbicide applications
- yellow no spray zone
- double blue sensitive areas in which a minimum of 24 months shall elapse between herbicide applications

VII. PROCEDURES AND LOCATIONS FOR HANDLING, MIXING AND LOADING OF HERBICIDE CONCENTRATES

The herbicide application crew will wear protective clothing and personal safety equipment when mixing, handling, loading or applying herbicide, including standard work clothing or coveralls, work gloves and work boots. Latex or nitrile rubber gloves, as well as eye goggles are recommended to be worn during mixing of herbicide concentrate as ARSENAL and ROUNDUP herbicides may cause mild eye and skin irritations.

Mixing and use of herbicide shall be consistent with the labeling instructions included on the packaging. The herbicide mix will be prepared from herbicide concentrate and water. In compliance with the regulations, the handling, mixing and/or loading if this material will not occur within 100 feet of any Sensitive Area. Wherever and whenever possible, the herbicide applicator will prepare the herbicide mix on non-porous surfaces, such as pavement or concrete.

Sources of Water and Safeguards to Prevent Contamination

Water used for herbicide mix will be obtained from hydrants and freshwater sources. During the herbicide mix preparations and during herbicide application, strict adherence to the following safeguards will be maintained:

1) Water will be obtained using hoses equipped with anti-siphon devises to eliminate herbicide backflow.
   a) Hoses used to extract water from waterbodies will be equipped with two such devises: one will be found directly behind the mouth of the hose and another will be at the coupling which joins the hose to the mix tank.
   b) Hoses used to extract water from the hydrant will utilize the same setup as described above, except that a third anti-siphon device will be found within the coupling joining the hose to the hydrant.

2) The herbicide concentrate will not be added to the tank until the water has been obtained and the application apparatus is at least 100 feet outside a Sensitive Area.

Disposal of Herbicidal Wastes

Disposal of all herbicidal wastes will be the responsibility of the licensed applicator. It is the applicator's responsibility to ensure that such disposal will be carried out in an environmentally sensitive manner, in compliance with all Federal and State regulations and guidelines.

VIII. EMERGENCY CONTACTS

In the event of a spill or emergency, information on safety precautions and cleanup procedures may be gathered from the following sources:

Herbicide Label

Herbicide Fact Sheet

Herbicide Material Safety Data Sheet

Herbicide Manufacturer	
DuPont	(800) 424-9300
Monsanto	(314) 694-4000
Massachusetts Pesticide Bureau	(617) 727-3020
Massachusetts Department of Environmental Protection	(617) 292-5500
Chemtrec	(800) 424-9300
EPA Pesticide Hotline	(800) 858-7378
Massachusetts Poison Control Center	(800) 682-9211
Local Community Chief of Police	_____

Ashland	(508) 881-1212	E. Bridgewater	(508) 378-7223
Attleborough	(508) 222-9614	E. Brookfield	(508) 867-6358
Auburn	(508) 832-7777	Everett	(617) 389-2120
Avon	(508) 583-6677	Fall River	(508) 673-0012
Becket	(413) 555-1212	Fitchburg	(508) 345-9656
Berkley	(508) 822-7040	Foxborough	(508) 543-4343
Berlin	(508) 838-7355	Framingham	(508) 872-1212
Bolton	(508) 779-2276	Freetown	(508) 763-4017
Boston	(617) 247-4200	Grafton	(508) 839-2858
Braintree	(617) 843-1212	Hinsdale	(413) 655-2712
Bridgewater	(508) 697-0914	Holbrook	(617) 767-1212
Brimfield	(413) 245-3442	Holliston	(508) 429-1212
Brockton	(508) 941-0200	Huntington	(413) 667-8868
Brookfield	(508) 867-2233	Lakeville	(508) 947-4425
Brookline	(617) 730-2222	Lancaster	(508) 368-1380
Cambridge	(617) 498-9300	Leicester	(508) 892-3626
Charlton	(508) 248-5868	Leominster	(508) 534-7560
Chester	(413) 354-7822	Mansfield	(508) 261-7300
Clinton	(508) 999-0733	Marlborough	(508) 624-6951
Dalton	(413) 684-0300	Medfield	(508) 359-2315
Dartmouth	(617) 389-2120	Middleborough	(508) 947-1214

*Middlefield	(413) 623-5060
Millbury	(508) 865-3521
Monson	(413) 267-5136
Montgomery	(413) 862-4545
Natick	(508) 651-7281
New Bedford	(508) 991-6300
Newton	(617) 552-7240
Northborough	(508) 393-1515
Norton	(508) 285-6301
Norwood	(617) 762-6888
Oxford	(508) 987-0156
Palmer	(413) 283-8792
Pittsfield	(413) 443-1651
Quincy	(617) 479-1212
Randolph	(617) 963-1212
Rayham	(508) 824-2716
Richmond	(413) 442-3693
*Russell	(413) 862-3345
Seekonk	(508) 336-8510
Sherborn	(508) 653-2424
Somerville	(617) 625-1600
Southborough	(508) 485-2121
Spencer	(508) 885-6333
Springfield	(413) 787-6313
Sterling	(508) 422-7331
Sudbury	(508) 443-8862
Taunton	(508) 824-7522
W. Bridgewater	(508) 586-2528
W. Brookfield	(508) 867-6888
W. Springfield	(413) 732-7421
W. Stockbridge	(413) 298-5530
Walpole	(508) 668-1095
Warren	(413) 436-9595
Washington	(413) 623-5111
Wellesley	(617) 235-1212
Westborough	(508) 366-8801
Westfield	(413) 562-5411
Weston	(617) 893-4803
Westwood	(617) 326-1903
Wilbraham	(413) 596-3837
Worcester	(508) 799-8600

*Fire Department

APPENDICES

A. Herbicide Fact Sheets as approved by the Department

B. Maps locating the ROW and Sensitive areas not readily identifiable in the field.

Maps provided with the Yearly Operational Plan shall remain effective for the duration of the YOP unless modified. Subsequent YOPs will contain any modifications to the maps made during the previous year.

APPENDIX A

HERBICIDE FACT SHEETS

NOTE: The Department of Food and Agriculture (DFA) has not published a Herbicide Fact Sheet for the herbicide Karmex which is proposed for use in non-sensitive yard areas. Questions about Karmex may be directed to the DFA at (617) 727-3000 extension 135.

HERBICIDE FACT SHEET

MASSACHUSETTS DEPARTMENT OF FOOD & AGRICULTURE
100 Cambridge Street, Boston MA 02202 (617) 727-7712 *August Schumacher Jr., Commissioner*

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GLYPHOSATE

Common Trade Name(s): Roundup, Rodeo, Accord

Chemical Name: N-(phosphonomethyl)glycine-isopropylamine salt

CAS No.: 1071-83-6

GENERAL INFORMATION

Glyphosate, n-phosphonomethyl glycine is a systemic, broad spectrum herbicide effective against most plant species, including deeprooted perenial species, annual and biennial species of grasses, sedges, and broadleafed weeds. The major pathway for uptake in plants is through the foliage, however, some root uptake may occur. The presence of surfactants and humidity increases the rate of absorption of glyphosate by plants (15).

Foliarly applied glyphosate is readily absorbed and translocated from treated areas to untreated shoot regions. The mechanism of herbicidal action for glyphosate is believed to be inhibition of amino acid biosynthesis resulting in a reduction of protein synthesis and inhibition of growth (10, 15, 101).

Glyphosate is generally formulated as the isopropylamine salt in aqueous solution (122). Of the three products containing glyphosate considered here, Roundup is sold with a surfactant and Rodeo and Accord are mixed with surfactants prior to use (15). Glyphosate has been reviewed by US Forest Service (15), FAO (122), and EPA ODW (51).

ENVIRONMENTAL FATE

Mobility

Glyphosate is relatively immobile in most soil environments as a result of its strong adsorption to soil particles. Adsorption to soil particles and organic matter begins almost immediately after application. Binding occurs with particular rapidity to clays and organic matter (15). Clays and organic matter saturated with iron and aluminum (such as in the Northeast) tend to absorb more glyphosate than those saturated with sodium or calcium. The soil phosphate level is the main determinant of the amount of glyphosate adsorbed to soil particles. Soils which are low in phosphates will adsorb higher levels of glyphosate (14, 15).

Glyphosate is classified as immobile by the Helling and Turner classification system. In soil column leaching studies using aged (1 month) glyphosate, leaching of glyphosate was said to be insignificant after 0.5 inches of water per day for 45 days (14).

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Persistence

It has been reported that glyphosate dissipates relatively rapidly when applied to most soils (14). However, studies indicate that the soil half-life is variable and dependent upon soil factors. The half-life of glyphosate in greenhouse studies when applied to silty clay loam, silt loam, and sandy loam at rates of 4 and 8 ppm was 3, 27 and 130 days respectively, independent of application rate (14). An average half-life of 2 months has been reported in field studies for 11 soils (15).

Glyphosate is mainly degraded biologically by soil micro-organisms and has a minimal effect on soil microflora (15). In the soil environment, glyphosate is resistant to chemical degradation such as hydrolysis and is stable to sunlight (15). The primary metabolite of glyphosate is aminomethyl phosphonic acid (AMPA) which has a slower degradation rate than glyphosate (15). The persistence of AMPA is reported to be longer than glyphosate, possibly due to tighter binding to soil (14). No data are available on the toxicity of this compound.

Glyphosate degradation by microorganisms has been widely tested in a variety of field and laboratory studies. Soil characteristics used in these studies have included organic contents, soil types and pHs similar to those that occur in Massachusetts (117).

Glyphosate degradation rates vary considerably across a wide variety of soil types. The rate of degradation is correlated with microbial activity of the soils and does not appear to be largely dependent on soil pH or organic content (117). While degradation rates are likely temperature dependent, most reviews of studies do not report or discuss the dependence of degradation rate on temperature. Mueller et al. (1981 cited in 117) noted that glyphosate degraded in Finnish agricultural soils (loam and fine silt soils) over the winter months; a fact which indicates that degradation would likely take place in similar soils in the cool Massachusetts climate. Glyphosate half-lives for laboratory experiments on sandy loam and loamy sand, which are common in Massachusetts, range up to 175 days (117). The generalizations noted for the body of available results are sufficiently robust to incorporate conditions and results applicable to glyphosate use in Massachusetts.

TOXICITY REVIEW

Acute (Mammalian)

Glyphosate has reported oral LD50s of 4,320 and 5,600 mg/kg in male and female rats (15,4). The oral LD50s of the two major glyphosate products Rodeo and Roundup are 5,000 and 5,400 mg/kg in the rat (15).

A dermal LD50 of 7,940 mg/kg has been determined in rabbits (15,4). There are reports of mild dermal irritation in rabbits (6), moderate eye irritation in rabbits (7), and possible phototoxicity in humans (9). The product involved in the phototoxicity study was Tumbleweed marketed by Murphys Limited UK (9). Maibach (1986) investigated the irritant and the photo irritant responses in individuals exposed to Roundup (41% glyphosate, water, and surfactant); Pinesol liquid, Johnson Baby Shampoo, and Ivory Liquid dishwashing detergent. The conclusion drawn was that glyposate has less irritant potential than the Pinesol or the Ivory dishwashing liquid (120).

Metabolism

Elimination of glyphosate is rapid and very little of the material is metabolized (6,106).

Subchronic/Chronic Studies (Mammalian)

In subchronic tests, glyphosate was administered in the diet to dogs and rats at 200, 600, and 2,000 ppm for 90 days. A variety of toxicological endpoints were evaluated with no significant abnormalities reported (15,10).

In other subchronic tests, rats received 0, 1,000, 5,000, or 20,000 ppm (57, 286, 1143 mg/kg) in the diet for 3 months. The no observable adverse effect level (NOAEL) was 20,000 ppm (1,143 mg/kg) (115). In the one year oral dog study, dogs received 20, 100, and 500 mg/kg/day. The no observable effect level (NOEL) was 500 mg/kg (116).

Oncogenicity Studies

Several chronic carcinogenicity studies have been reported for glyphosate including an 18 month, mouse study; and two year rat study. In the rat study, the animals received 0, 30, 100 or 300 ppm in diet for 2 years. EPA has determined that the doses in the rat study do not reach the maximum tolerated dose (112) and replacement studies are underway with a high dose of 20,000 ppm (123). The mice received 1000 5000 or 30,000 ppm for 18 months in their diets. These studies were non-positive (112,109). There was a non-statistically significant increase in a rare renal tumor (renal tubular adenoma (benign) in male mice (109). The rat chronic study needs to be redone with a high dose to fill a partial data gap (112). The EPA weight of evidence classification would be D: not classified (51).

Mutagenicity Testing

Glyphosate has been tested in many short term mutagenicity tests. These include 7 bacterial (including *Salmonella typhimurim* and *B. subtilis*) and 1 yeast strain *Sacchomyces cerevisiae* as well as a mouse dominant lethal test and sister chromatid exchange. The microbial tests were negative up to 2,000 mg/plate (15), as were the mouse dominant lethal and the Chinese hamster ovary cell tests. EPA considers the mutagenicity requirements for glyphosate to be complete in the Guidance for the Registration of Pesticide Products containing glyphosate (112).

Developmental Studies

The developmental studies that have been done using glyphosate include teratogenicity studies in the rat and rabbit, three generation reproduction studies in the rat, and a reproduction study in the deer mouse. (15)

Rats were exposed to levels of up to 3,500 mg/kg/d in one rat teratology study. There were no teratogenic effects at 3,500 mg/kg/d and the fetotoxicity NOEL was 1,000 mg/kg/d. In the rabbit study a fetotoxicity NOEL was determined at 175 mg/kg/d and no teratogenic effects were observed at 10 or 30 mg/kg/d in one study and 350 mg/kg/d in the other study (15). No effects were observed in the deer mouse collected from conifer forest sprayed at 2 lbs active ingredient per acre (15).

Tolerances & Guidelines

EPA has established tolerances for glyphosate residues in at least 75 agricultural products ranging from 0.1 ppm (most vegetables) to 200 ppm for animal feed commodities such as alfalfa (8).

U.S. EPA Office of Drinking Water has released draft Health Advisories for Glyphosate of 17.50 mg/L (ten day) and 0.70 mg/L (Lifetime)(51).

Avian

Two types of avian toxicity studies have been done with glyphosate: ingestion in adults and exposure of the eggs. The species used in the ingestion studies were the mallard duck, bobwhite quail, and the adult hen (chickens). The 8 day feeding LC50s in the mallard and bobwhite are both greater than 4,640 ppm. In the hen study, 1,250 mg/kg was administered twice daily for 3 days resulting in a total dose of 15,000 mg/kg. No behavioral or microscopic changes were observed (15).

Invertebrates

A variety of invertebrates (mostly arthropods) and microorganisms from freshwater, marine, and terrestrial ecosystems have been studied for acute toxic effects of technical glyphosate as well as formulated Roundup. The increased toxicity of Roundup compared with technical glyphosate in some studies indicates that it is the surfactant (MONO 818) in Roundup that is the primary toxic agent (117). Acute toxicity information may be summarized as follows:

Glyphosate (technical): Acute toxicity ranges from a 48 hr EC50 for midge larvae of 55 mg/L to a 96 hr TL50 for the fiddler crab of 934 mg/L (15).

Roundup: Acute toxicity ranges from a 48 hr EC50 for Daphnia of 3 mg/L to a 96 hr LC50 for crayfish of 1000 mg/L (15).

Among the insects tested, the LD50 for honeybees was 100 mg/bee 48 hours after either ingestion, or topical application of technical glyphosate and Roundup. This level of experimental exposure is considerably in excess of exposure levels that would occur during normal field applications (15).

Aquatic Species (Fish)

Technical glyphosate and the formulation Roundup have been tested on various fish species. Roundup is more toxic than glyphosate, and it is the surfactant that is considered to be the primary toxic agent in Roundup:

Glyphosate (technical): Acute 96 hr LC50s range from 24 mg/L for bluegill (Dynamic test) to 168 mg/L for the harlequin fish (15).

Roundup: Acute lethal toxicity values range from a 96 hr LC50 for the fathead minnow of 2.3 mg/L to a 96 hr TL50 for rainbow trout of 48 mg/L (15).

Tests with Roundup show that the egg stage is the least sensitive fish life stage. The toxicity increases as the fish enter the sac fry and early swim up stages.

Higher test temperatures increased the toxicity of Roundup to fish, as did higher pH (up to pH 7.5). Above pH 7.5, no change in toxicity is observed.

Glyphosate alone is considered to be only slightly acutely toxic to fish species (LC50s greater than 10 mg/L), whereas Roundup is considered to be toxic to some species of fish, having LC50s generally lower than 10 mg/L (15,118).

SUMMARY

Glyphosate when used as recommended by the manufacturer, is unlikely to enter watercourses through run-off or leaching following terrestrial application (117). Toxic levels are therefore unlikely to occur in water bodies with normal application rates and practices (118).

Glyphosate has oral LD50s of 4,320 and 5,600 in male and female rats respectively. The elimination is rapid and very little of it is metabolized. The NOAEL in rats was 20,000 ppm and 500 mg/kg/d in dogs. No teratogenic effect was observed at doses up to 3,500 mg/kg/d and the fetotoxicity NOELS were 1,000 mg/kg/d in the rat and 175 mg/kg/d in the rabbit.

The evidence of oncogenicity in animals is judged as insufficient at this time to permit classification of the carcinogenic potential of glyphosate. The compound is not mutagenic.

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HERBICIDE FACT SHEET

MASSACHUSETTS DEPARTMENT OF FOOD & AGRICULTURE
100 Cambridge Street, Boston MA 02202 (617) 727-7712 *August Schumacher Jr., Commissioner*

Massachusetts grown...and fresher!

IMAZAPYR

Common Trade Name(s): Arsenal

Chemical Name: Imazapyr/
2-(4-isopropyl-4-methyl-5-oxy-2-imidazolin-2-yl)
nicotinic acid with isopropyl amine (2)

CAS No.: 81510-83-0

GENERAL INFORMATION

Imazapyr is effective against and provides residual control of a wide variety of annual and perennial weeds, deciduous trees, vines and brambles in non-cropland situations. It also provides residual control and may be applied either pre- or postemergence. Postemergence is the preferred method especially for the control of perennial species. Imazapyr is readily absorbed by the foliage and from soil by the root systems. Imazapyr kills plants by inhibiting the production of an enzyme, required in the biosynthesis of certain amino acids, which is unique to plants (10, 100).

ENVIRONMENTAL FATE

Mobility

There are few studies which have investigated the mobility of Imazapyr in soil, but available reports indicate that Imazapyr does not leach and is strongly absorbed to soil (100). Imazapyr has a high water solubility (1 - 1.5%) which could generally indicate a high leaching potential, but as with other organic acids Imazapyr is much less mobile than would normally be expected (100). No soil partition coefficients have been reported, but they may be expected to be quite high (100).

One field study investigated Imazapyr mobility in a sandy loam soil (0.9% organic matter, 8.0% clay; 38.8% silt). Imazapyr did not leach below the 18-21 inch layer after 634 days and 49.6 inches of rain. The levels found below the 12 inch layer were just above the 5 ppb detection limit. In addition, this study investigated the off-target mobility of Imazapyr and found no residues further than 3 inches from the sprayed area after 1 year (102).

Although low levels of Imazapyr did move to the 18 to 21 inch layer this was only after nearly 2 years and fifty inches of rain. This indicates that imazapyr is relatively non-mobile and does not leach through the soil profile. Imazapyr remains near the soil surface and heavy preciptation may cause some off target movement from surface erosion of treated soils.

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Persistence

The main route of Imazapyr degradation is photolysis. In a study of photodegradation in water, the half-life of Imazapyr was calculated as 3.7, 5.3 and 2.5 days in distilled water, pH 5 and pH 9 buffers respectively (101). A soil photolysis study for Arsenal on sandy loam calculated a half-life of 149 days (101).

Studies have investigated the persistence of Imazapyr in soil under aerobic and anaerobic conditions. The half-life of Imazapyr in soil has been reported as varying from 3 months to 2 years (100). A laboratory study found the half-life to be 17 months (101). Detectable residues were found in a field study in all soil layers to 21 inches at 634 days (102). Vegetation was sprayed with radiolabelled Imazapyr at a rate of 1 lb. a.i./acre. The soil was a sandy loam (0.9% organic matter) which received 49.6 inches of rain during 634 days. The highest level of radioactivity (0.234 ppm Imazapyr) was found in the top 3 inches of soil at 231 days after application and there were detectable levels in the 9-12 inch layer. The concentrations in the top layer increased steadily from day 4 to 231 when they reached their maximum (0.234 ppm) and then declined. At day 634 the level in the top layer (0-3 inch) was 0.104 ppm (102). These data indicate that Imazapyr is persistent in soil and, most importantly, that Imazapyr is translocated within plants from the plant shoots back to the roots and released back into soil. Very little of the Imazapyr actually reached the soil during application. The soil residues may be due to the decay of plant material containing Imazapyr in the soil (102).

TOXICITY REVIEW

Acute (Mammalian)

The acute oral LD50 in both male and female rats was greater than 5000 mg/kg using technical Imazapyr. The acute dermal LD50 in male and female rabbits was greater than 2000 mg/kg. The compound was irritating to the rabbit eye but recovery was noted 7 days after application of 100 mg of the test substance. It was classified as mildly irritating to the rabbit skin following application of 0.5 grams of the material on abraded or intact skin (103).

Arsenal product formulation was tested in a similar battery of tests. The rat oral LD50 value was greater than 5000 mg/kg and the rabbit dermal LD50 was greater than 2148 mg/kg. The irritation was observed following installation of 0.5 ml of the test substance in the skin study and 0.1 ml in the eye study (104).

Technical Imazapyr was administered to rats as an aerosol for four hours at a concentration of 5.1 mg/L. There were ten rats per sex and the animals were observed for 14 days after treatment before they were sacrificed. Slight nasal discharge was seen in all rats on day one but disappeared on day two (105).

The inhalation LC50 is greater than 5.0 mg/L for both the formulation and the technical product (105,106).

Technical Imazapyr was applied dermally at the following dosages: 0, 100, 200 and 400 mg/kg/day (109). Arsenal was used at 0, 25, 50 and 100% of the formulated solution in sterile saline. Each dose group consisted of 10 male and 10 female rabbits and the test substance was applied to either intact or abraded skin and occluded for 6 hours each day.

The result of the dermal studies with Imazapyr as well as Arsenal were non remarkable with regard to body weights, food consumption, hematology, serum chemistry, clinical observations, necropsy observations and histopathology. It was noted that Arsenal, undiluted, was locally irritating (109).

Subchronic and Chronic Studies (Mammalian)

In the subchronic tests a NOEL for systemic toxicity with dermal administration in rabbits was 400 mg/kg/d (2,109). After dietary administration for 13 weeks in the rat, there was no effect at 10,000 ppm (571 mg/kg/d) which was the highest dose tested (141).

A bioassay is currently underway to evaluate the potential oncogenicity of technical Imazapyr. Groups of 65 rats per sex per dose group have received 0, 1000, 5000 or 10,000 ppm in the diet. Hematology, clinical chemistry and urinalysis tests were conducted at 3, 6 and 12 months and will also be done at 18 months and at study termination. At the 12 month sacrifice the only effect noted was a slight increase in mean food consumption in all treated female groups. Most of the increases were statistically significant, but they did not always exhibit a dose response. The oncogenicity test is due to be submitted to the EPA in the spring of 1989 (115).

Oncogenicity Studies

Chronic bioassays as discussed in the subchronic/chronic section are underway.

Mutagenicity Testing

Five different bacterial strains of *Salmonella typhimurium* (TA1535, TA98, TA100, TA1537, and TA1538) and one of *Escherichia coli* (WP-2 uvrA-) were used to evaluate the mutagenicity of Imazapyr. It is unclear whether the compound used was technical or formulated Imazapyr. Dose levels up to 5000 micrograms/plate were used and each strain was evaluated both in the presence or absence of PCB-induced rat liver S-9 microsomes. Negative results were noted in all assays. The six tester strains were designed to detect either base-pair substitutions or frameshift mutations (113).

Developmental Studies (Mammalian)

Two teratology studies have been done and both of these studies evaluated technical Imazapyr. One study used rats as the test species and the other utilized rabbits (111,112).

Pregnant rats received dosages of 0, 100, 300 or 1000 mg/kg/d of Imazapyr during days 6-15 of gestation. There were 22 rats in the control group and 24, 23 and 22 in the low, mid and high dose groups. All doses were administered orally by gavage. Salivation was noted only during the dosing period in 6 of the 22 females in the highest dose group (1000 mg/kg). No other adverse observations were noted in the treated dams (111).

Fetal body weight and crown-rump length data for the treated groups were comparable to controls. Fetal development (external, skeletal and visceral) "revealed no aberrant structural changes which appeared to be the result of the exposure to Imazapyr" (111). The NOEL for maternal toxicity was 300 mg/kg and the NOEL for teratogenicity and fetoxicity was 1000 mg/kg (116).

Four groups of 18 pregnant rabbits were exposed on days 6-18 of gestation to doses of 0, 25, 100, 400 mg/kg/d Imazapyr. There was no statistically significant difference between control and treated groups at any dose (112).

Avian

Acute oral LD50s of Imazapyr in bobwhite quail and mallard duck were 2150 mg/kg. The 8 day dietary LC50 in the bobwhite quail and mallard duck were greater than 5000 ppm (101).

Invertebrates

The dermal honey bee LD50 for Imazapyr is greater than 100 mg/bee (101). The LC50 (48 hr) was greater than 100 mg/L for the water flea (100).

Aquatic

The LC50s of Imazapyr in the rainbow trout, bluegill sunfish and channel catfish were greater than 100 mg/L (101).

SUMMARY

Imazapyr is a relatively immobile herbicide in the soil profile even when used in sandy and low organic content soils. It is also persistent in soils. The low mobility and persistence may result in off-target movement of Imazapyr from surface erosion of treated soils.

The atypical soil-plant flux characteristics of Imazapyr and delayed maximum soil concentrations indicate that repeated annual applications may result in build-up of Imazapyr in soil. Consequently, an interval is required to allow for the degradation of soil residues before a repeated application is made.

The oral LD50 of Imazapyr in rats is greater than 5000 mg/kg and the dermal LD50 is greater than 2000 mg/kg in rabbits. The oncogenicity bioassay is currently underway and the only effect reported in the interim study was an increase in food consumption in the treated females. No mutagenic effects were observed.

The acute oral LD50s of Imazapyr and the Arsenal formulation are greater than 5000 mg/kg. In the subchronic 13 week rat study there was no effect observed at the highest dose tested 10,000 ppm. The oncogenicity study is currently underway.

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HERBICIDE FACT SHEET

MASSACHUSETTS DEPARTMENT OF FOOD & AGRICULTURE
100 Cambridge Street, Boston MA 02202 (617) 727-7712 *August Schumacher Jr., Commissioner*

Massachusetts grown...and fresher!

SULFOMETURON METHYL

COMMON TRADE NAME(S): **Oust**

CHEMICAL NAME : **N-[4,6-dimethylpyrimidin-2-yl) amino-carbonyl] -2-methoxycarbonylbenzenesulfonamide**

CAS NO : **74222-97-2**

GENERAL INFORMATION

Sulfometuron methyl, the active ingredient in herbicide Oust, is a member of the new group of sulfonylurea herbicides. Sulfometuron Methyl is a broad-spectrum selective weed control agent used in non-crop areas. Oust is applied pre- or post-emergence which provides control against many broad-leaf weeds and grasses through contact and residual activity. (15)

ENVIRONMENTAL FATE

Mobility

The mobility of sulfometuron methyl has been reported in literature and the database available is complete. Sulfometuron methyl is a weak acid (pKa 5.2) and consequently, adsorption coefficients were calculated for various soils at pH values of 5, 6, and 7. In a low organic matter soil (1%) the adsorption coefficients were 2.0, 0.8 and 0.3 at the respective pH values. This study indicates that sulfometuron methyl is more strongly adsorbed to soil as the pH decreased, and as organic matter increases. (15)

Soil thin layer chromatography and adsorption coefficients were performed and calculated for four standard soils. K(d) values ranged from 0.71 to 2.85 and Rf values ranged from 0.33 to 0.85 indicated a moderate mobility. In addition, soil column studies using the same four soils indicate a moderate to moderately high mobility pesticide. K(oc) values calculated from the soil K(d) values range from 61 to 122 which is lower than the EPA guideline of 400. (101)

In a field mobility study, sulfometuron methyl was applied to soil tubes in five locations (delaware, North Carolina, Oregon, Colorado, and Saskatchewan, Canada) at a rate of 1 lb. a.i./Acre. There was no report of rainfall at these sites. Each application at a different time making it

difficult to compare results. Samples were taken for a minimum of a year and at some for two years, and at 8 cm (3 in) intervals to 32 cm (12

inches). Results indicate that sulfometuron methyl is moderately mobile under most conditions. One surprising fact is that immediately after application, all locations had detectable residues in a layer below the top layer of soil, and in two locations (Colorado and Oregon) in the deepest layer sampled. All locations except Delaware also had detectable residues at the 24-32 cm layer at other times during the study. There are also indications that sulfometuron methyl would leach further than the deepest soil layer which was sampled. (102)

Persistence

Sulfometuron methyl is degraded by microbial action, photo-decomposition and by hydrolysis at acidic pH's. The photolysis half-life on soil is between 1 to 2 weeks and in distilled water, approximately 160 hours. The hydrolysis half-life at pH 2 and 5 is 100 and 475 hours respectively. At neutral or basic pH's, sulfometuron methyl is stable to hydrolysis. (15, 100, 101)

Reports indicate that the overall rate of sulfometuron methyl degradation in soil depends on pH and soil moisture content. Half-lives of one week were reported under laboratory conditions, but field studies at neutral pH revealed greater persistence. Increased soil moisture content resulted in increased degradation rates, but only approximately 10%. (15, 101)

The soil half-life is reported as four weeks with longer times in colder conditions. A review of available studies, however reveals that the shortest half-life was six weeks in Delaware. In the same study the half-life ranged from six weeks to one year in Oregon. (15, 102)

The reported half-life of four weeks is relatively short and would not be cause for concern. However, it seems evident that in most circumstances it may be significantly longer. In all cases reported in this study, the half-life was six weeks or longer and a more realistic estimate may be closer to two months. Another point discussed in the literature is the lack of any significant degradation during the cold periods of the year. Applications in the late fall could lead to longer half-lives and thereby more potential for increased leaching.

The field study discusses the faster degradation rates of sulfometuron methyl in e=the east as possibly attributable to the more acidic and moister soils in the east. This is certainly true and may in fact have contributed to shorter half-lives, but a point which is not discussed was the timing of the applications. The two western sites were treated in early to mid-July, whereas the western sites were treated in the fall. Saskatchewan was treated in late July, but the climate at that location is cooler and becomes much colder.

TOXICITY REVIEW

Acute (Mammalian)

Five animals per sex per group were gavaged with sulfometuron methyl suspended in corn oil at a dosage of 5,000 mg/kg. Gross pathological examination revealed slight weight increase in the lungs that were pale red with grey foci in males and similar lung effects in one female. In addition, four females had a pink thymus and one had a slight liver weight. The oral LD50 in male and female ChR-CD rats was determined to be greater than 5,000 mg/kg. (110)

The inhalation LC50 was tested in groups of five male and five female Crl:CD rats. Rats were exposed to control air or test concentrations of either 6.4 or 11 mg/L. There were no clinical or pathological differences between controls or test groups. The inhalation LC50 was greater than 5.0 mg/L (111) while sulfometuron methyl was tested at 6.4 and 11 mg/L. The EPA cutoff for LC50 concentration is 5 mg/L.

Acute skin absorption LD50 tests were performed on five male and five female New Zealand white rabbits. Doses of 2,000 mg/kg of pesticide were applied to abraded skin on the back of the rabbit. Clinical signs in males were sporadic weight loss, slight erythema 1 to 2 days after treatment and diarrhea at 11 days. Gross pathological examination showed no changes due to the test material. The dermal LD50 in rabbits was greater than 2,000 mg/kg. (112)

In a separate acute dermal LD50 test, four groups of five adult male and one group of five adult female which New Zealand rabbits were used. Groups of males were dosed at the following levels: 1,500 mg/kg, 2,000 mg/kg, and 8,000 mg/kg and the females were dosed at 2,000 mg/kg. Clinical signs in all the groups of males were moderate to mild redness and sporadic weight loss. The animals in the two highest dose experienced mild swelling, the 2,000 mg/kg group showed moderate swelling while the 1,500 mg/kg group had slight swelling. Clinical signs in the females were severe to mild redness, severe to slight swelling and sporadic weight loss. There were no compound related pathological observations. There was one death in the male 2,000 kg/mg group, but it was not believed to be related to the compound. The LD50 for the acute skin absorption in rabbits was greater than 2,000 mg/kg. (116)

Eye irritation studies were performed by placing 10 mg of solid test material in the conjunctival ac of each of two albino rabbits. There were no corneal or iritic effect. However, there was redness (1 hour to 1 day; not washed eyes and mild for 1 hour unwashed eyes); swelling (1 to 4 hours unwashed eyes) and no discharge was observed. Both washed and unwashed eyes were normal within 1 to 2 days. (113)

In guinea pigs, both primary skin irritation and sensitization tests were run. Ten animals per group were exposed to 0.05 ml of either a 50% or a 5% suspension of sulfometuron methyl. The 50% suspension showed mild to no skin irritation response in 24 hours and no irritation at 48 hours. The 5% suspension reproduced no skin irritation. There was no sensitization response. (114)

The oral LD50 test was conducted with the formulation using young male and female adult Crl:CD rats, five rats per group. 5,000 mg/kg was administered by gavage in a 25% suspension in corn oil. The only clinical finding was alopecia in males. Gross pathological examination showed in both males and females slightly heavy lungs that were pale to pale red with red to dark red foci and white mottling in 1 to 3 animals. The LD50 is greater than 5,000 mg/kg. Additionally in a range finding study, no mortalities were seen in doses from up to 7,500 mg/kg. (115)

Nine male albino rabbits were tested for eye irritation studies. The right eyes were treated with 0.1 ml (61.8 mg) of test material. The left eyes served as untreated controls. Results indicated a transient localized area of slight corneal cloudiness in 2 of the 6 unwashed eyes. The eyes returned to normal in 2 to 3 days. Two of the three eyes treated and washed showed a transient localized area slight corneal cloudiness and mild conjunctivitis with no iritic effects. The washed eyes returned to normal within 3 to 4 days. This compound was considered a slight to mild irritant. (117)

Skin irritation tests were conducted on six male albino rabbits. Doses of 0.5 g of solid pesticide (moistened with saline) were applied to two intact and two abraded skin areas on each rabbit. Each rabbit serves as its own control; treated areas were compared to adjacent untreated areas. Observations and scoring were done by the method of Draize (118) and at 24 and 72 hours after exposure. The compound was not found to be a primary irritant on either intact or abraded skin of rabbits. (119)

Primary skin irritation tests were performed on ten guinea pigs. The procedure was the same as used in testing the technical sulfometuron methyl. Doses of 0.05 ml of a 50% suspension of the pesticide in dimethyl phthalate was used. The 50% suspension caused mild to no irritation in five of the animals. No irritation was caused by the 5% suspension. No sensitization response was observed. (120)

Subchronic and Chronic Studies (Mammalian)

Male and female CD-1 mice were fed diets to which had been added 0, 100, 1,000, or 7,500 ppm (0, 13.3, 133, or 997 mg/kg) (a) sulfometuron methyl for 90 days. Hematological evaluations were conducted on all mice (tail cut bleeding at approximately 1, 2 and 3 months after study initiation. All mice were sacrificed and necropsied at 90 days. Organs were weighed and examined histologically. Male mice fed the diet containing 7,500 ppm pesticide showed reduced mean body weights and weight gains. Growth of the 100 and 1,000 ppm groups of males and all treated females was the same as that in the control group. No mortalities occurred. (121)

Hemolytic effects were seen as a result of dietary exposure to sulfometuron methyl in all groups. Significant increases in leukocyte count were found in the 7,500 ppm (997 mg/kg) males. There

were statistically significant changes in other blood parameters that were not does related. Mean absolute and relative liver weights were elevated in all male treatment groups. Histological examination revealed bile stasis in five of ten males in the 7,500 ppm group. In the females, a slight increase in relative liver weight and increased hepatocellular cytoplasmic granularity was observed. Decreases in both mean and relative thymus weights were observed in all treated male groups. Thymic cortical atrophy occurred in three males in the 7,500 ppm group and one male in the 100 ppm group. Because of low frequency of occurrence 7,500 and 100 ppm and absence in the 1,000 ppm group, the thymic cortical atrophy is not considered to be related to the decreased thymus wrights. Based on the observed hemolytic effect, there was no NOEL from this study.

In a second mouse study, five groups of 80 males and 80 female Crl:CD-1(1CR)BR mice were fed diets containing one of the following concentrations of sulfometuron methyl: 0. 5, 20, 100, or 1,000 ppm (0, 0.66, 2.66, 13.3, 133 mg/kg) for 18 months. Food consumption was monitored throughout the study, mice were weighted and hematological evaluations were performed at regular intervals. At 18 months, mice were sacrificed and necropsied. Mean body weights and mean body weight gains in all treatment groups except for the 1,000 ppm female group were comparable to control groups. Sporadic changes in weight gain were observed in that group.

(a)
In these discussions the assumptions made for conversion of ppm (diet) to mg/kg/D were:

SPECIES	BODYWEIGHT (kg)	INTAKE ((kg)
Rat	0.35	0.020
Mouse	0.03	0.004
Dog	10	0.4

(133)

When data was presented as ppm the does was estimated in mg/kg and is presented in parenthesis.

Mild anemia was observed in the female 1,000 ppm group as evidenced by statistically significant decreases in erythrocyte count, hemoglobin concentration and hematocrit. There was also a significant increase in mean corpuscular volume and platelet count. While the hematological results appear to differ from those in the 90 day mouse study, the data indicate that there were several statistically significant changes in some blood parameters at the three month (90 day) sampling time which were not apparent at other sampling times. However, although reticulocyte smears were made, they were not evaluated and it cannot be ascertained that a response to a

hemolytic effect actually occurred. If it did, a NOEL in this strain of mice for a hemolytic effect at 90 days in the 18 month study would be 5 ppm. There was a non-dose related but, statistically significant increase in the incidence of amyloidosis in the female 1,000 ppm groups, but no specific target organ was identified. The overall NOEL for dietary intake of sulfometuron methyl for male and female mice was 1,000 ppm (133 mg/kg) and 100 ppm (13.3 mg/kg) respectively under the conditions of this study based on body weight, body weight gain, clinical pathology and pathological findings. (124)

Groups of 16 male and 16 female CD rats were fed diets containing 0, 100, 1,000, 5,000 ppm (0, 5.7 57, 285 mg/kg) sulfometuron methyl. At 1, 2 and 3 months after the study initiation, hematological, urological and clinical chemistry evaluations were performed. At the end of the study, ten rats from each group were sacrificed and evaluated pathologically. There were no differences between treatments and controls in body weight, weight gain, food consumption and food efficiency. There were no mortalities. The only clinical sign observed was alopecia in three males in the 100 ppm group. The male 5,000 ppm treatment group showed slightly elevated mean leukocyte counts, increased mean relative number of lymphocytes and decreased mean relative number of neutrophils. Due to the effects of white blood cells in male 5,000 ppm group, the NOEL dietary concentration i this study was 1,000 ppm (56 mg/kg/D). (122)

Four groups of five male and five female New Zealand white rabbits were dermally exposed to either 1, 125, 500, or 2,000 mg/kg, six hours per day for 21 consecutive days. After the exposure period, three male and three female rabbits per group were sacrificed for pathological evaluation. The remaining two males and two females from each group were sacrificed and evaluated pathologically following a two week recovery period. Clinical signs observed in rabbits from all test groups including controls were sporadic weight loss and diarrhea. Histopathological and clinical pathological examination showed no compound-related effects. One rabbit did after the eighth dose from causes not related to the test substance. (123)

Groups of 80 male and 80 female Crl:CD (SD) BR rates were fed diets containing 0, 50, 500 or 5,000 ppm (0, .8, 28.5, or 285 mg/kg) sulfometuron methyl for approximately two years. Hematological, clinical chemistry and urological testing was conducted a 3, 6, 9, 12, 18, and 24 months. After 12 months, ten male and ten female rats per group were randomly selected, sacrificed and pathologically examined. At 24 months, all surviving rats were sacrificed, necropsied, and examined pathologically.

In the female 5,000 ppm group, food consumption throughout the study was slightly depressed and overall mean weight gain during the first year and mean body weights during the second year were significantly depressed. There were no abnormalities in appearance or behavior observed during the study.

Decreased erythrocyte count and hematocrit in the male 500 and 5,000 ppm groups were

observed at the 24 month clinical evaluation suggesting a minimal dose-related hemolytic effect. There were no other compound related hematological, clinical chemistry or urological abnormalities observed. Mean absolute brain weights were significantly lower in the male 5,000 ppm group at both one and two sacrifice times. However, no abnormal gross or histological observation were noted. Mean relative and absolute thymus weight of the 500 and 5,000 ppm males was decreased compared to controls at terminal sacrifice. Man testes weights of rats in the 5600 and 5,000 ppm groups were less than controls.

Histological examinations revealed dose-dependent increases in the incidence of bile duct hyperplasia and fibrosis in the female 500 and 5,000 ppm groups at the two year sacrifice. Severity of the lesions were minimal to mild, suggesting a slightly toxic effect of sulfometuron methyl on the livers of these female rats.

The NOEL in this strain of rat under these study conditions was 50 ppm (2.8 mg/kg/D). (125)

Groups of six male and six female dogs (aged 4 to 5 months) were fed diets containing 1, 200, 1,000, or 5,000 ppm (0, 8, 40, 200 mg/kg) of sulfometuron methyl. Hematological, clinical, chemistry, and urological testing was performed at one and two months prior to and at one, three, six, nine, and twelve months after initiation of the study. At 12 months, the dogs were sacrificed and examined histopathologically.

There were no differences between treatments and controls in mean body weight, weight gain, food consumption and food efficiency (kg body weight gained/kg food consumed). There were no abnormalities observed in either appearance or behavior and no deaths occurred during the course of the study. A mild hemolytic anemia was diagnosed in the 5,000 ppm males and the 1,000 and 5,000 ppm females. Statistically significant dose-related decreases in erythrocyte counts, hematocrit and hemoglobin were observed. In the female 1,000 and 5,000 ppm groups, elevated mean corpuscular hemoglobin occurred and increased hemosiderin deposition in the spleens of the 5,000 ppm females was observed. Several statistically significant changes in blood chemistry indices occurred in the 1,000 and 5,000 ppm groups. An increase in serum alkaline phosphatase activity was observed in both the male and female 5,000 ppm groups. The female 5,000 ppm group showed an increase in serum cholesterol levels. Serum albumin levels decreased in the male 1,000 and 5,000 ppm group. These changes were not considered biologically significant due to the relative magnitude of the changes, the absence of alterations in other clinical indices and the absence of compound dependent histomorphological abnormalities.

All histological changes were unremarkable. These effects occurred with similar frequencies in treatments and controls and were not considered to be compound related.

The NOEL for dogs based on the hemolytic effects was 200 ppm (8 mg/kg/D) in this study. (126)

Oncogenicity Studies

Oncogenic endpoints were evaluated in the chronic mouse and rat studies for sulfometuron methyl. Crl: CD-1 (1 CR) BR mice received 0, 5, 20, 100, or 1,000 ppm sulfometuron in the diet of 18 months. There were no compound related increases in tumor incidence (124). CRL:CD (SD) BR rats received 0, 50, 500, or 5,000 ppm sulfometuron in the diet for two years. There was no increase in frequency of occurrence of tumors in these rats (125). Sulfometuron methyl is not carcinogenic in rats and mice under these conditions.

Mutagenicity Testing

The Ames Salmonella/microsome assay tested the ability of Sulfometuron methyl to revert four strains of Salmonella typhimurium from histidine dependence to histidine independence. The assay was performed both with and without a rat liver homogenate (S-9) activation system. The test substance was found not to be mutagenic for these strains of bacteria under the test conditions at doses from 2.5 to 1,000 mg/plate. (129)

Frequency of chromosome aberrations was tested in CHO cells both with and without metabolic activation (S-9). The doses tested ranged from 300 ug/ml to 10 ng/ml in a half log series. No increase in chromosome aberrations was observed in culture exposed under the test conditions to these concentrations of the test material. (130)

The CHO cell line was used to test mutations in the gene coding for the enzyme hypoxanthine-guanine phosphoribosyl transferase (HGPRT) both in the presence and absence of an activation (S-9) system. Concentration of the test material ranged from 0 to .1 mM. No mutagenic activity was detected. (131)

The ability of sulfometuron methyl to induce unscheduled DNA (UDS) synthesis in freshly isolated rat hepatocytes was tested. Concentrations of test material ranged for 1 X 10 -5 to 1.0 mM in half log increments. Under these test conditions, no induction of UDS was detected. (132)

Developmental Studies

Groups of 17 female artificially inseminated rabbits wee gavaged with test material on days 6 to 18 of gestation. Dosage levels were 0, 30, 100, and 300 mg/kg suspended in 0.5% methylcellulose in water. Animals were sacrificed on day 29 of gestation and fetuses wee removed by cesarean section. No treatment-related effects were observed in the maternal clinical observations or gross pathology. There were no statistically significant differences

between control and treatment groups in any of the other parameters measured (maternal body weight changes, clinical observations, survival, gross pathology pregnancy rates, numbers and percentages of corpora lutea, implantations, resorptions in each maternal animal, fetal sex, viability and development). Under the conditions of this study, sulfometuron methyl was not considered to be teratogenic in New Zealand white rabbits. (127)

A teratology study was conducted using female Crl:CD (SR) BR rats which were fed a diet containing sulfometuron methyl. Concentrations of 0, 50, 1,000, and 5,000 ppm were used. Thirty-five rats were used as controls, 25 rats were assigned to the 50 and 1,000 ppm group and 15 rats were assigned to the 5,000 ppm group. Rats were fed the test diet on days 6 to 15 of gestation and sacrificed on day 21 of gestation for gross and histological examination. (128)

Rats on the highest dose level gained significantly less weight and ate significantly less feed than controls. The fetuses of this exposure group weighted significantly less than those of the control dams. No other adverse effects were noted in the lower exposure groups. No teratogenicity was demonstrated in this study. The minimum effect level of maternal toxicity and embryofetal toxicity was 5,000 ppm (286 mg/kg) and the NOEL under these study conditions was 1,000 ppm (57 mg/kg). (128) Reproductive studies were performed in conjunction with the 90 day feeding study in rats and the two year feeding study in rats.

In the 90 day feeding study (122), six male and six female rats which had been fed diets obtaining 0, 100, 1,000, and 5,000 ppm of sulfometuron methyl (for 90 days) were mated and delivered litters. No adverse effects were observed as indicated by fertility, gestation, viability and lactation indies. In addition, there wee no differences between treatment and controls in the mean body weights and survival of weaning pups.

In the two year feeding study (125), 20 rats per group were used in a two generation, four litter reproduction study, initiated 90 days after the start of the long-term feeding study. Fo rats were mated. Females were allowed to give birth and F1a pups wee followed until weaning (21 days) at which time they were sacrificed. Fo females wee again mated, but to different Fo males. F1b pups were delivered and observed. At weaning, 20 males and 20 females were selected from each dietary level (0, 50, 500, and 5,000 ppm) and continued on the treatment for 90 days. F1b rats were bred twice within their respective group, producing F2a and F2b litters. Ten males and ten females from the F2b litters were sacrificed and examined histologically. (125)

During the 90 day feeding period for F1b rats, body weight and diet consumption were decreased in the female 5,000 ppm group. The number of pus born and the number of pups born alive to the 5,000 ppm groups was consistently lower in both the F1 and F2 generations and was statistically significant for F2b litters. Decreased pup counts may reflect the general health status of the mother as evidenced by decreased body weight and diet consumption of the F1b 5,000 ppm group. No gross or histopathological changes or effects on organ weights were observed in the weaned F2b rats. The NOEL established, based on this sub-study was

500 ppm (28 mg/kg). (125)

Avian Toxicity

Sulfometuron methyl has been tested in the bobwhite qual and the mallard duck. The 8 day dietary LC50's were greater than 5,620 and 5,000 ppm respectively. The acute oral LD50 in the mallard duck was greater than 5,000 mg/kg. (101)

Invertebrate Toxicity

The aquatic invertebrate, Daphnia magna was tested ant he 48 hour LC50 was greater than 12.5 ppm sulfometuron methyl. (15)

Aquatic Toxicity

Species tested on the aquatic toxicity studies include bluegill sunfish (96 hour) and rainbow trout (96 hour). In both cases the LC50 was greater than 12.5 ppm.

A life stage study was done using the fathead minnow. There wee no effects observed on embryo hatch, larval survival or growth at concentrations of 1.2 mg/L or less. (15)

SUMMARY

Sulfometuron methyl is a material both moderately mobile and moderately persistent would be appropriate for use in sensitive areas. A closer look at the material however, reveals that the Oust is applied at the average rate of five ounces of product (3.75 oz a.i.)/acre or 106 grams per acre. These studies were conducted with applications of 1 lb a.i./acre. The lower application rates both minimize the persistence of sulfometuron methyl in soil and thereby diminish the amount of material which is available to leach through the soil. Therefore, sulfometuron may be used if the application rates are kept sufficiently low. This is because the soil organic material and soil microorganisms are able to absorb and degrade lower rates of pesticides.

The oral LD50 in rats for sulfometuron methyl is greater than 5,000 mg/kg and the dermal LD50 is greater than 2,000 mg/kg in rabbits.

The sub-chronic and chronic
NOELS are 50 ppm (2.8 mg/kg/D) in rates; 200 ppm (i mg/kg/D) in dogs; and 5 ppm (0.66 mg/kg/D) at 90 days for the reversible hemolytic effect and 100 ppm (13.3 mg/kg/D) at two years in the mouse. This makes the mouse at 90 days the most sensitive species with a transient hemolytic effect, to sulfometuron methyl exposure.

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APPENDIX B

MAPS

NOTE: Maps of sensitive areas along the right-of-way have been provided in previous Yearly Operational Plans. Please refer to these maps. New maps will continue to be provided only as they are updated or modified.

APPENDIX F

NOISE AND VIBRATION TECHNICAL MEMORANDUM

1. MEASURES OF NOISE AND VIBRATION

1.1 Noise Descriptors

The most commonly used measure of noise is the A-weighted sound level, expressed in decibels (dBA). The A-weighted sound level is a single-number measure of sound pressure level with weighted frequency characteristics that correspond to human subjective response to noise. It is universally accepted by acousticians as a proper unit for describing environmental noise.

An understanding of the following is helpful in providing a subjective impression of changes in the A-weighted sound level:

- Except in carefully controlled laboratory experiments, an increase of only 1 dBA in sound level cannot be perceived;
- Outside the laboratory, a 3 dBA increase in sound level is considered a barely noticeable difference;
- A change in sound level of at least 5 dBA is required before any significant change in a community would be perceived;
- A 10 dBA increase in sound level is subjectively heard as approximately a doubling in loudness.

Following is a list of noise metrics and their definitions, all based on A-weighted sound level and commonly used in analyses of community noise.

Maximum Level, L_{max}: As a train approaches, passes by and then recedes into the distance, the A-weighted sound level at a fixed wayside location rises, reaches a maximum, and then fades into the backgroun noise. The maximum sound level reached during this pass-by is called the Maximum Level, abbreviated L_{max}.

L_{max} is commonly used in vehicle noise specifications and is often measured to characterize the noise from individual vehicles. However, L_{max} is not normally used as the descriptor for train noise impact assessment for several reasons. L_{max} ignores the number and duration of train events, which are important to people's reaction to noise, and cannot be summed into

a time-cumulative measure of impact, such as over a 24-hour period. Moreover, L_{max} is not conducive to comparison among different transportation modes or equipment types. The cumulative descriptors used for such assessments are discussed below.

Sound Exposure Level, SEL: The quantitative measure of the noise does for single noise events is the Sound Exposure Level, or SEL. The fact that SEL is a cumulative measure means that (1) louder events have higher SELs than do quieter ones, and (2) events that last longer in time have higher SELs than do shorter ones generating the same L_{max}. People react to the duration of noise events, judging longer events to be more annoying than shorter ones.

Quantitatively SEL can be considered equivalent to the total sound energy of an event normalized or "squeezed" into a one-second time duration. Hence, unlike L_{max}, SEL increases with the duration of a noise event and also allows for a uniform assessment method for different types of transit modes and/or vehicle types. Also, SEL can be mathematically totalled to obtain the one-hour and 24-hour cumulative descriptors defined below.

Equivalent Sound Level, L_{eq}: Because environmental noise fluctuates from moment to moment, it is common practice to condense all this information into a single number, called the "equivalent" or "energy average" sound level, or L_{eq}. Because many surveys show that L_{eq} properly predicts annoyance, this descriptor is commonly used for noise impact assessment. L_{eq} can be thought of as the steady sound level that represents the same sound energy as the varying sound levels over a specified time period.

Commonly used equivalent noise descriptors are the $L_{eq}(h)$, measured over a one-hour period, and the $L_{eq}(24)$, measured over a 24-hour period. The L_{eq} during the noisiest hour of the day (peak-hour L_{eq}), is used as the official noise metric for the Federal Highway Administration (FHWA) in noise abatement studies.

Day-Night Sound Level, L_{dn}: One of the most widely accepted measures of cumulative noise exposure in residential areas is the Day-Night Sound Level, abbreviated L_{dn}. The L_{dn} is the A-weighted equivalent sound level over a 24-hour period with an additional 10-decibel weighting imposed on noise that occurs during the nighttime hours (between 10:00 pm and 7:00 am).

Except for extreme situations, L_{dn} is generally found to range between 55 dBA and 75 dBA

in populated areas. L_{dn} has been formally adopted by most public agencies dealing with noise exposure, including the Federal Aviation Administration (FAA), the Department of Defense, and the Department of Housing and Urban Development (HUD).

Exceedance Level, L_n: Environmental noise can also be viewed on a statistical basis using percentile sound exceedance levels, L_n, which refer to the sound level exceeded "n" percent of the time. For example, the sound level exceeded 90 percent of the time (L_{90}) is often considered to represent the "background" noise in a community. Similarly, the sound level exceeded 33 percent of the time (L_{33}) is often used to approximate the L_{eq} from traffic in the absence of sporadic events such as aircraft overflights and train passages.

1.2 Vibration Descriptors

As trains pass over railroad tracks, forces are generated between the train wheels and the rails that cause ground motion. Although the amplitude of this motion is too small to be seen, they can be felt, especially if the observer is very close to the tracks. This motion is known as ground-borne vibration. Ground-borne vibrations propagate away from the tracks as waves, in much the same manner as ripples propagate across the surface of a pond. One important aspect of ground vibration is that they diminish with distance from the tracks.

Vibration is defined as an oscillatory motion of an object about some equilibrium position which can be described in terms of displacement, velocity or acceleration. Although displacement is easier to understand than velocity or acceleration, it is rarely used for describing ground-borne vibration. One reason for this is that most vibration sensors are designed to provide output signals proportional to either velocity or acceleration. Even more important, the response of humans, buildings and equipment to vibration is more accurately described using velocity or acceleration. Because sensitivity to vibration has typically been found to correspond to a constant level of vibration velocity amplitude within the low frequency range of most concern for environmental vibration (roughly 5 to 100 Hz), vibration velocity is used in this analysis to describe ground-borne vibration from train operations.

There are several different descriptors that are used to quantify vibration amplitude. One of the most common is the peak particle velocity (PPV), defined as the maximum instantaneous positive or negative peak of the vibratory motion. PPV is often used in monitoring blasting vibration since it is related to the stresses experienced by building components. Although PPV is appropriate for evaluating the potential for building damage,

it is less suitable for evaluating human response which is better related to an average vibration amplitude. Because the net average of a vibration signal about its equilibrium position is zero, the root mean square (rms) amplitude is often used to describe the "smoothed" amplitude. The rms amplitude is defined as the average of the squared amplitude of the signal, and is typically evaluated over a one-second period of time.

Based on the above discussion, rms vibration velocity has been selected as the basic descriptor of ground-borne vibration for the present analysis. Although velocity is normally described in units of inches per second in the USA, the decibel notation, which acts to compress the range of numbers required to describe vibration magnitude, can also be used. In this notation, the vibration magnitude is expressed in terms of velocity level, in decibels, defined as follows:

$$V_{db} = 20 \log_{10} \left(\frac{v}{v_{ref}} \right)$$

where: v = rms velocity, in./sec

v_{ref} = 1×10^{-6} in./sec

Thus, the descriptor used in this analysis for the assessment of ground-borne vibration is the rms vibration velocity level, V_{db}, expressed in decibels relative to one μinch per second.

1.3 Frequency-Related Descriptors

Both sound and vibration are described by oscillating waves at one or more specific frequencies measured in hertz (Hz). The wave motion can occur at a single frequency, such as a tuning fork or a "pure tone", or at different frequencies simultaneously. Most sound and vibration signals obtained in practice consist of many frequencies occurring simultaneously that cannot be reflected in a single number or decibel level.

The frequency components can be revealed by plotting wave amplitude (either sound or vibration level) against frequency. The breakdown of acoustic signals into individual frequency components is called *spectral analysis*, and this type of plot is known as a *frequency spectrum*. A frequency spectrum can be analyzed using different bandwidths depending on the range or resolution desired. For most environmental analysis either octave band or one-third octave band levels are sufficient. Octave band analysis is an example of a constant

percentage bandwidth spectrum, and each octave is defined as a frequency range where the maximum frequency is twice the minimum frequency. An octave band level is all of the sound or vibration energy that occurs within the minimum and maximum frequencies of a specific octave band. Each octave band is divided into three one-third octave bands.

2. NOISE AND VIBRATION IMPACT CRITERIA

This section provides a summary of the impact and mitigation criteria used in the noise and vibration assessment for the Worcester Commuter Rail Extension Project. The following standards were considered during development of the criteria:

- Both current official and unofficial Federal Transit Administration (FTA, formerly UMTA) guidelines;
- Noise policy of the Massachusetts Department of Environmental Protection (DEP);
- The criteria implemented in the Old Colony Railroad Rehabilitation Project during its environmental assessment process;
- Various other federal agency standards (FHWA, HUD, etc.).

Although an advantage of the Old Colony criteria is that they hold precedence in their prior application to an MBTA-sponsored project, it is important to keep in mind that these criteria were originally developed in 1986 before the availability of *any* federally-authorized noise and vibration criteria for railroad or mass transit projects. In the meantime, improved criteria have since been developed for FTA which were adopted for this project. The details of the proposed criteria and selection process are presented here.

2.1 Noise Impact Criteria

The significance of noise impacts were assessed using criteria that are specific to each of the following components of the Worcester Commuter Rail Extension Project: (1) train operations along the rail corridor from Framingham to Worcester, (2) train operations in the proposed layover facility, (3) grade crossing warning devices, (4) project-generated motor vehicle traffic near proposed commuter rail stations, and (5) short-term construction activities at and in the vicinity of the proposed station sites. Impact criteria for each of these

components are summarized in Table 1 and discussed below.

Table 1. Summary of Noise Impact Criteria

IMPACT CATEGORY	SOURCE OF IMPACT	MEASURE OF IMPACT	IMPACT CRITERIA
NOISE	Train noise at noise-sensitive receivers.	Projected increase in L_{dn} compared with existing conditions.	Proposed FTA Noise Impact Criteria. (see Fig. 1)
	Layover Facility and Grade Crossing warning devices (i.e. horns)	i) Projected increase in L_{dn} compared with existing conditions; ii) Pure-tone condition.	i) Proposed FTA Criteria; ii) Massachusetts DEP noise policy.
	Traffic noise near proposed stations.	Projected increase in peak hour L_{eq} compared with existing conditions.	Current FTA criteria (increase greater than 5 dBA).
	Construction noise at noise-sensitive land use.	Projected Annual Average L_{dn} from construction.	Projected Annual Average L_{dn} > 65 dBA.

2.1.1 Train Noise

Noise impacts from train operations on the rail corridor and in the new layover facility were assessed based on a comparison between the existing and projected noise levels expected after project implementation. This increase will be measured in terms of the day-night sound level, L_{dn}. This noise metric correlates well with the effects of noise on people and is the environmental noise measure recommended by the U.S. Environmental Protection Agency (EPA). L_{dn} represents the total dose of noise energy at a given outdoor location over a 24-hour period in terms of the A-weighted sound level (dBA), with an additional 10 dB weighting imposed on the equivalent sound levels occurring during the nighttime hours (10 pm to 7 am). L_{dn} is only applied for residences and other buildings where people normally sleep.

The standards by which a project-generated increase in L_{dn} is designated as significant impact vary according to the regulating agency involved as well as the current "thinking" of the time. Following is a discussion of three slightly different standards which are applicable to commuter rail, including that used for the Old Colony Project.

2.1.1.1 *Old Colony Project Noise Criteria*

The approach used for noise impact assessment in the Old Colony commuter rail restoration project takes into account two undesirable effects of re-establishing rail service into a community: the noise levels generated may be high enough to interfere with human activities such as speech, sleep or concentration, or the new source may increase the ambient noise level sufficiently to cause general annoyance. As a result, noise impact was assessed by comparing the project-generated noise levels (in the absence of any other noise sources) with an "absolute" standard and then by comparing the resultant increase in community noise with a "relative" standard.

Absolute impact for commuter rail operations is based only on the L_{dn} resulting from the A-weighted sound levels of trains passbys, according to standards assigned to land uses with varying noise sensitivities, as shown in Table 2.

The "Impact" levels shown are consistent with levels identified by other federal agencies such as HUD and FAA as the upper limit of compatibility with land uses shown. Noise from the project in this range is considered to be significant, and may qualify for mitigating measures.

The "Mitigation" noise levels are identified where the project noise is severe enough to <u>require</u> noise abatement measures. These noise levels are 10 dBA higher than those commonly used for rapid transit facilities. There are a number of reasons for the higher limits:

- Commuter rail trains usually operate every 1/2 hour during the morning and after peak periods and on an intermittent schedule during the remainder of the day. They rarely operate in the nighttime hours. Rapid transit trains operate on a much more regular schedule.

- The locomotives are often the source of the maximum sound level from a commuter rail train. In contrast, each vehicle on a rapid transit train creates similar noise levels. As a result, the maximum noise levels during the passage of a commuter train last for a shorter period of time than the maximum noise levels of a rapid transit train.

- The railroad right-of-way has been in existence for many years, with train traffic a common occurrence for the alignment.

Table 2. Old Colony Absolute Noise Criteria

LAND USE DESIGNATION	DESCRIPTION	NOISE IMPACT LEVEL, L_{dn} (dBA)	
		Impact	Mitigation
Category 1.	Buildings and parklands where quiet is an important element in their intended purpose. This category includes tracts of land set aside for serenity and quiet and such land uses as outdoor concert pavilions.	60	65
Category 2.	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.	65	70
Category 3.	Institutional land uses with primarily daytime use. This category includes schools, libraries, churches, and active parks where it is important to avoid interference with such activities as speech, meditation and concentration on reading material. Offices where quiet is important, such as medical offices and conference rooms, fall into this category. Places of worship or meditation associated with cemeteries, monuments, and historical sites are also included.	70	75

Relative noise impact is assessed by comparing the future L_{dn} with the existing L_{dn}. If the increase in existing L_{dn} caused by project sources is 5 dBA or more, then relative impact is considered to occur. In slightly different terms, the project begins to cause relative impact if its average noise level is 3 dBA or more above the existing noise level in the vicinity of the project.

Finally, the criteria used for consideration of mitigation measures on the Old Colony project included all locations for which impact was identified. For residences, consideration for noise abatement would apply to all residences within the L_{dn} = 65 dBA contour. For those residences located between the L_{dn} 65 and 70 dBA contours, the relative noise criterion was applied and considerations of feasibility and

reasonableness were made as additional requirements for noise abatement.

To summarize, the Old Colony criteria for noise mitigation are as follows, with reference to Table 2:

1. If the land use category lies between impact and mitigation levels, and:

   - there is no relative impact, then the site does not qualify for noise abatement measures;

   - there will be relative impact, but the mitigation measures do not meet cost-benefit criteria for reasonableness, then the site does not qualify for noise abatement measures;

   - there will be relative impact, and cost-benefit criteria are met, then the site qualifies for noise abatement measures.

2. If the land use category lies within the contour defining mitigation levels, then the site qualifies for and *requires* noise abatement measures. This involves either construction of a noise barrier or soundproofing of each individual building.

The cost-benefit criterion used was based upon the measure established by Massachusetts Department of Public Works (DPW, now MassHighway), prescribing an upper limit of $2400/dB/dwelling for noise barriers applied to the first floor only. Physical feasibility criteria are site-specific; that is, they are governed by such factors as track configuration, available right-of-way, and physical obstructions.

2.1.1.2 Current Federal Transit Administration Criteria

Noise impact criteria for transit projects seeking federal funding are included in UMTA Circular C 5620.1 by the U.S. Federal Transit Administration (FTA, formerly UMTA). These criteria are based solely on noise increase in terms of L_{dn}. The criteria consider noise increases of 3 dBA or less to be "generally not significant," noise increases of 4 or 5 dBA to be "possibly significant," and noise increases of more than 5 dBA to be "generally significant."

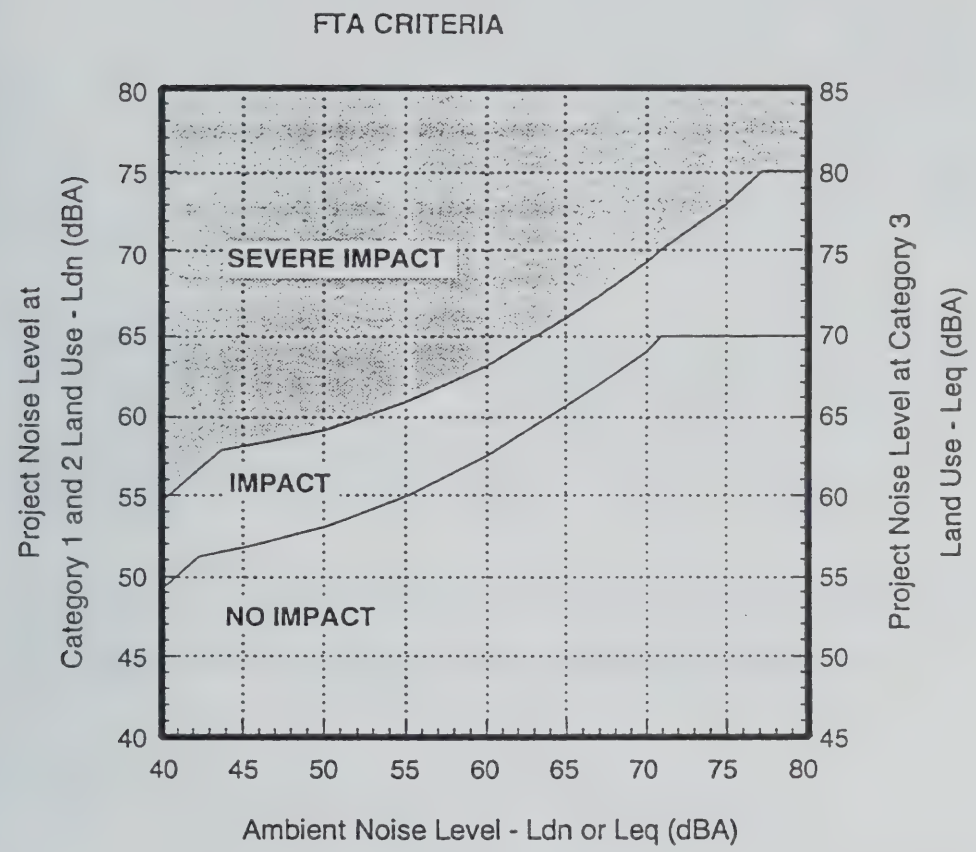
2.1.1.3 Proposed Federal Transit Administration Guidelines

Both the Old Colony and the current FTA criteria are lacking in that they do not take into account the varying sensitivity of communities to projects under different background noise conditions. FTA is

currently developing a "Guidance Manual for Transit Noise and Vibration Impact Assessment" which includes new criteria for noise and vibration impact evaluation. These criteria have been developed based on well-documented research into human response to community noise, as well as existing regulatory standards (EPA, APTA, HUD). The criteria are shown graphically in Figure 1, with the definitions of Land Use Categories 1, 2 and 3 corresponding to those described in Table 2.

The main difference between these new criteria and the two other standards described is that the criteria for both levels of impact vary according to the ambient noise and predicted project noise levels, and is determined by the threshold at which the percentage of people highly annoyed by the project noise is measurable and/or significant. In general, the criteria reflect an equivalent increase in noise annoyance depending on the existing noise level, allowing less of an increase at locations where existing noise levels are higher. Above a given upper limit of project noise, however, the impact is no longer dependent on the ambient level and is determined by project noise alone.

Below the lower curve in Figure 1, the project is considered to have no noise impact since, on the average, the introduction of the project will result in an insignificant increase in the number of people highly annoyed by the new noise. For project noise above the upper curve, FTA uses the term "Severe Impact," since a significant percentage of people would be highly annoyed by the new noise. Between the two curves, the project is judged to have an impact, though not significant. The change in the cumulative noise level is noticeable to most people, but may not be sufficient to cause adverse reactions from the community. In this transitional area, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation, such as the predicted level of increase over existing noise levels and the types and numbers of noise-sensitive land uses affected.



LAND USE CATEGORIES:

1. Tracts of Land Set Aside for Serenity and Quiet (Leq)
2. Residences and Buildings where People Normally Sleep (Ldn)
3. Institutional Land Use with Primarily Daytime or Evening Use (Leq)

Figure 1. FTA Noise Impact Criteria

2.1.1.4 Train Noise Impact Criteria for Worcester Commuter Rail Project

The FTA criteria described above are applicable to all rail projects (rapid transit, light rail, commuter rail and automated guideway transit) as well as fixed facilities such as storage and maintenance yards, passenger stations and terminals. The criteria are appropriate for different transit modes of operation, are sensitive to heightened community annoyance caused by late-night or early-morning transit service, and to communities' varying sensitivity to increased noise under different existing noise conditions. They prescribe similar conditions on project noise as the Old Colony criteria, yet were revised to reflect a more updated approach.

The conditions for mitigation were determined in a manner similar to the assessment performed for the Old Colony project. That is, (referring to Figure 1),

1. If the land use category lies within the FTA-defined "Severe Impact" zone, mitigation must be considered.

2. If the land use category lies within the "Impact" zone, and

   - the project does **not** cause a 5 dBA or more increase in the existing L_{dn}, then the site does not qualify for noise abatement measures;

   - the project causes a 5 dBA or more increase in the existing L_{dn}, but the mitigation measures do not meet cost-benefit criteria for reasonableness, then the site does not qualify for noise abatement measures;

   - the project causes a 5 dBA or more increase in the existing L_{dn}, and cost-benefit criteria are met, then the site qualifies for consideration of noise abatement measures.

2.1.2 Traffic Noise

The significance of noise impacts from project-generated traffic near proposed commuter rail stations along the rail corridor will be assessed based on the projected noise increase relative to the noise from existing sources. This may be significant, since there will be new access roads introduced through some residential areas. Because the greatest changes in traffic volumes are expected to occur during peak travel periods, the noise increase will be evaluated in terms of the peak-hour L_{eq}, or Equivalent Sound Level. This descriptor represents the cumulative one-hour exposure that accounts for the fluctuations in A-weighted Sound Levels due to all sound sources during that hour.

Criteria for traffic noise impact will be based on existing FTA guidelines. According to these guidelines, a noise level increase of greater than 5 dBA is considered to represent a significant impact. The existing FTA criteria are used here rather than the proposed FTA criteria due to the general, non-site specific nature of the traffic noise impact assessment. This assessment predicts only the change in traffic noise resulting from the projected change in traffic volumes near the stations and not the absolute traffic noise levels at specific noise-sensitive locations in the community.

Due to the general nature of the traffic noise impact assessment for this project, the specific Federal Highway Administration (FHWA) noise abatement criteria are not applicable. However, it should be noted that the FHWA-recommended peak-hour L_{eq} noise measure has been adopted to evaluate noise impact due to traffic changes.

2.1.3 Construction Noise

The significance of short-term noise impacts from project construction activities were assessed based on the Annual Average Day-Night Sound Level (AAL_{dn}), with a criterion of 65 dBA for noise-sensitive areas. Because construction is a transient activity, the daily phase L_{dn} are averaged over a one-year period based on durations and schedules to determine the AAL_{dn} at nearby noise-sensitive receivers.

2.2 Vibration Impact Criteria

Project vibration impacts from train operations and from construction activities will be assessed based on the criteria summarized in Table 3 and described below.

Table 3. Criteria for Vibration Impact

IMPACT CATEGORY	SOURCE OF IMPACT	MEASURE OF IMPACT	IMPACT CRITERION
VIBRATION	Train-induced ground vibration at vibration-sensitive land uses.	Projected rms ground vibration velocity level (V_{dB}), existing level, and number of events.	Projected level exceeds Proposed FTA Criteria, and there is an increase in the vibration level or number of events.
	Ground vibration from construction at vibration-sensitive land use.	Projected rms ground vibration velocity level (V_{dB}).	Projected level exceeds Proposed FTA Criteria.
	Ground vibration from blasting at nearby structures.	Projected peak particle velocity (PPV) on ground.	Projected velocity > 0.5 inch per second.

2.2.1 Vibration from Trains

Vibration impacts from train operations were assessed based on the projected root-mean-square (rms) ground vibration velocity level (V_{dB}) measured on the exterior ground surface at the building line location closest to the track. This level is expressed in decibels relative to a reference velocity of 10^{-6} inch per second. The criteria are given in terms of velocity because the sensitivity of humans, buildings and equipment to vibration has typically been found to correspond to a constant of vibration velocity amplitude within the low-frequency range of most concern for environmental vibration (roughly 5 to 100 Hz). Although the peak particle velocity (PPV) is commonly used to quantify vibration amplitude for blast damage criteria, response to train vibration is better related to the rms amplitude, defined as the average of the squared amplitude of the signal over a one-second time period. Although velocity is normally described in units of inches per second in the USA, the decibel notation, which acts to compress the range of numbers required to describe vibration, can also be used.

The effects of ground-borne vibration include feelable movement of the building floors, rattling of windows, items on shelves and walls, and "rumbling" sounds. In extreme cases, the vibration can cause damage to buildings. However, building damage is not normally a factor for transportation projects, with the occasional exception of blasting and impact-type pile driving during construction. Annoyance with vibration often begins when the vibration exceeds the threshold of perception by about 10 dB. This is an order of magnitude below the damage threshold for normal buildings.

The annoyance criteria for ground-borne vibration impact are based on those currently being proposed

for adoption of the FTA, and are also consistent with those used for the vibration impact assessment of the Old Colony rehabilitation project. These criteria, presented in Table 4, are based on the maximum rms ground vibration levels for a single event and account for land use as well as the frequency of events. Because the project involves potential changes in train vibration along an existing rail corridor already in use, impact from existing rail traffic (Amtrak and Conrail operations) was assessed only at locations where (1) project ground vibration levels exceed the criteria **and** (2) there will be a significant increase in the vibration magnitude. For the proposed MBTA commuter rail service, impact was assessed at all locations where the ground vibration levels are expected to exceed the absolute criteria.

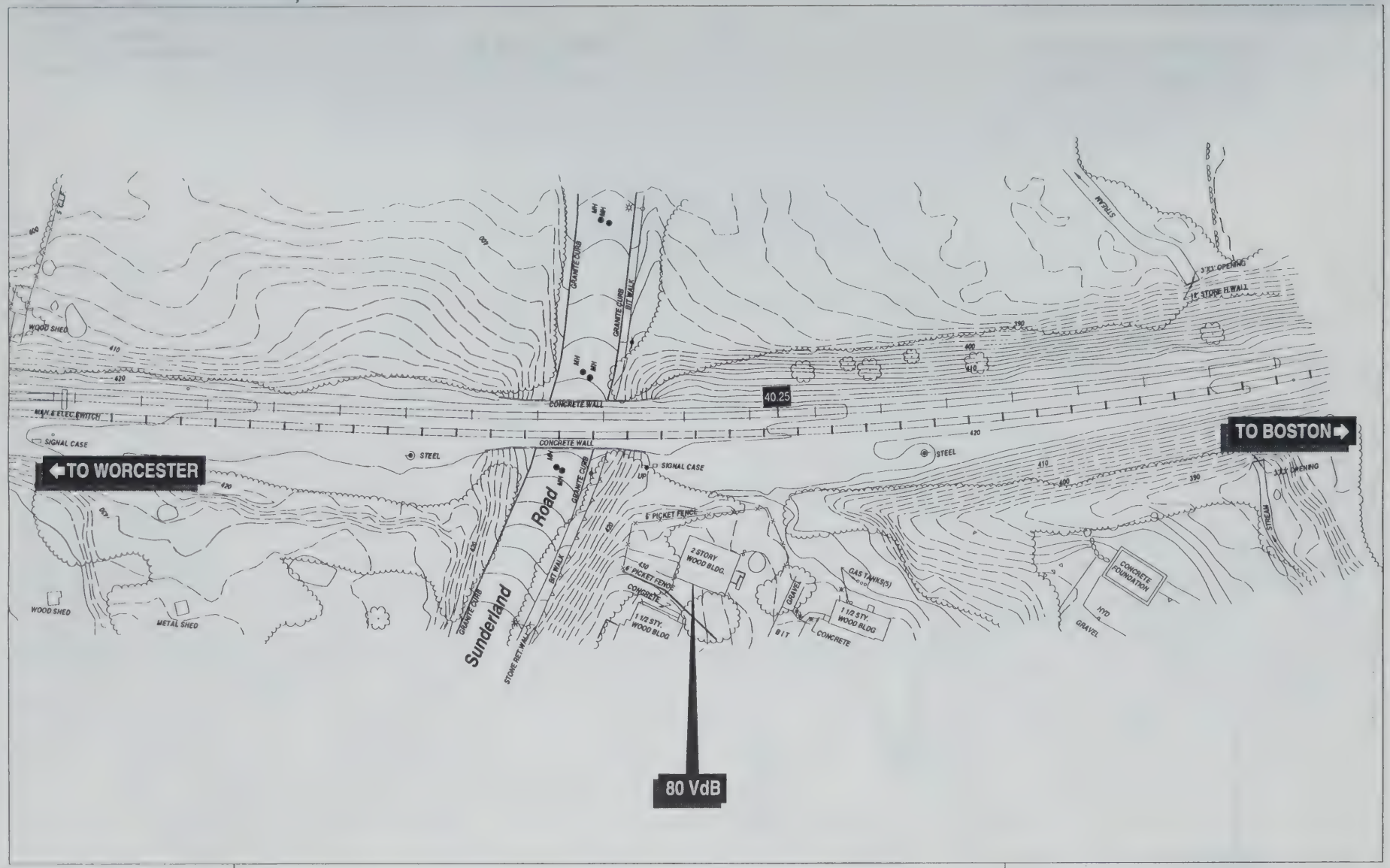
Table 4. Criteria for Train Vibration Impact

LAND USE CATEGORY	GROUND VIBRATION IMPACT LIMITS (rms Vibration Velocity Level in dB re 1 μin./sec)	
	Frequent Events[1]	Infrequent Events[2]
Category 1: Buildings where low ambient vibration is essential for interior operations.	65 V_{dB}	65 V_{dB}
Category 2: Residences and buildings where people normally sleep.	72 V_{dB}	80 V_{dB}
Category 3: Institutional land uses with primarily daytime use.	75 V_{dB}	83 V_{dB}

[1] "Frequent Events" is defined as more than 70 vibration events per day. Most transit systems fall into this category.

[2] "Infrequent Events" is defined as less than 70 vibration events per day. This category includes most commuter and inter-city rail systems.

Another area of concern is damage to buildings located near the right-of-way. The significance criteria for vibration damage are 100 V_{dB} for buildings in general, and 95 V_{dB} for fragile, historic buildings. However, damage is extremely unlikely except in unusual cases or when the track will be very close to the structure.



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 100'

0 100'

VIBRATION IMPACTS CITY OF WORCESTER

FIGURE F-1

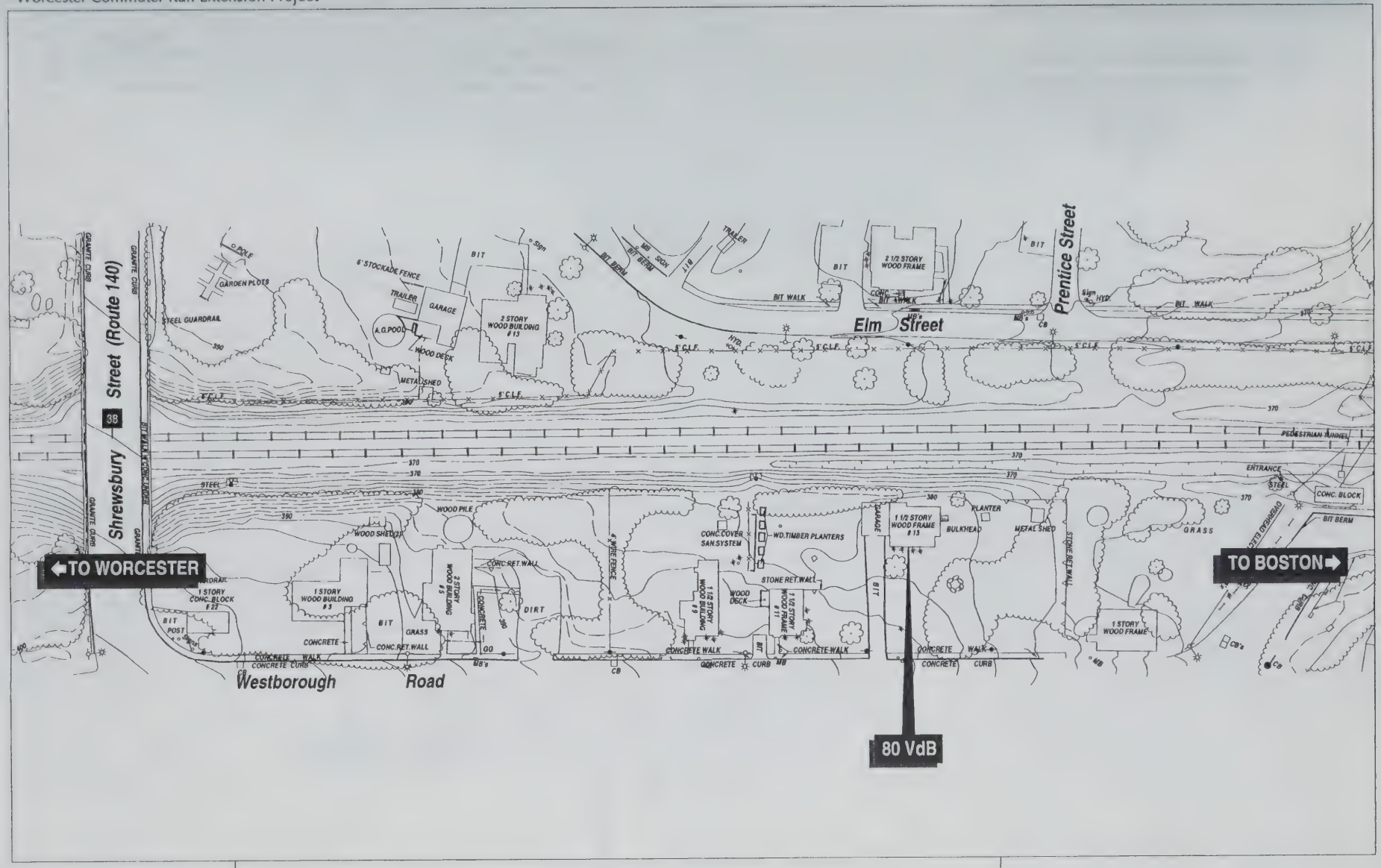
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 100'

0 100'

VIBRATION IMPACTS
CITY OF WORCESTER

FIGURE F-2



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 100'

0 100

VIBRATION IMPACTS TOWN OF GRAFTON

FIGURE F-3

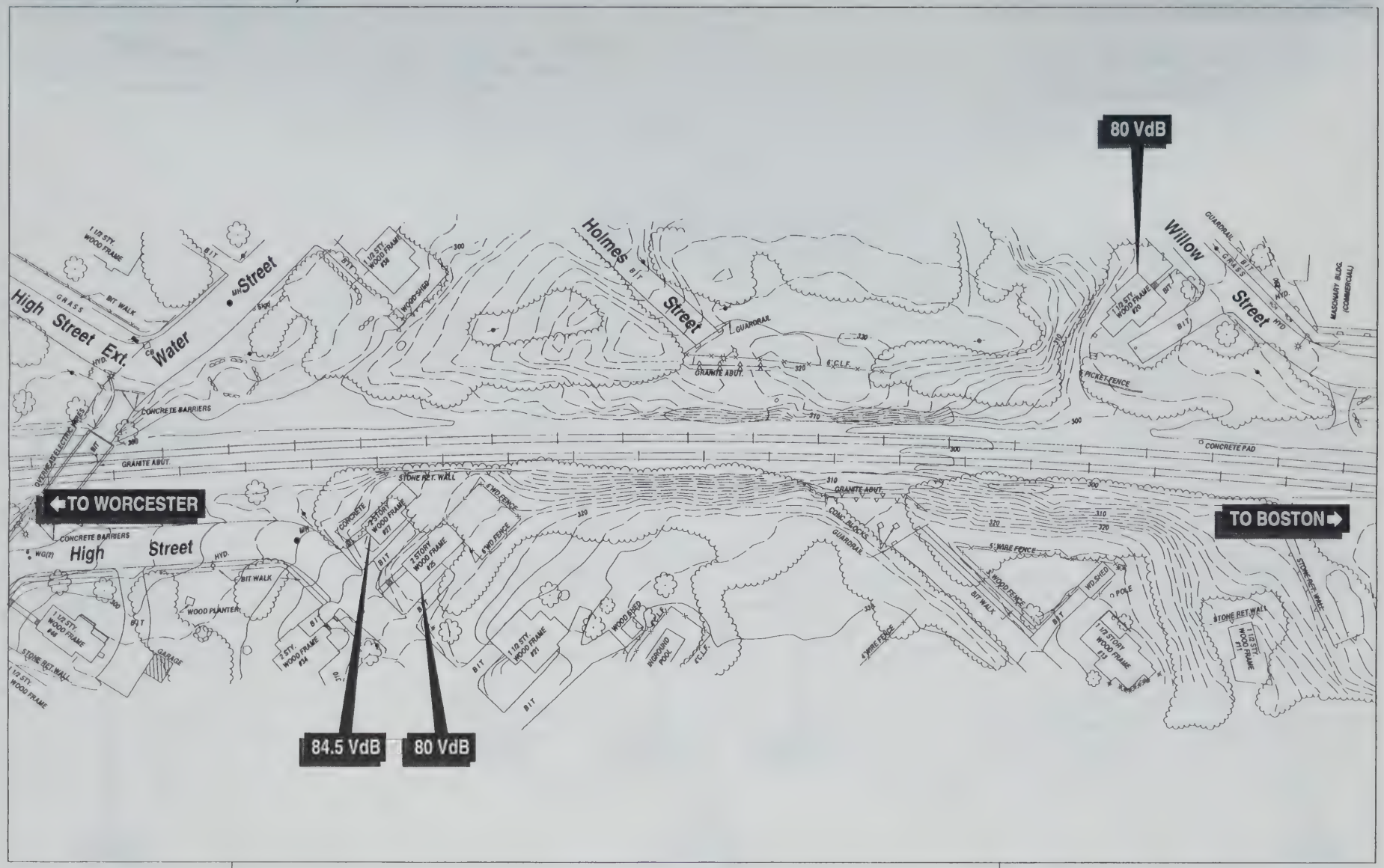
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 100'

0 100'

VIBRATION IMPACTS
TOWN OF WESTBOROUGH

FIGURE F-4



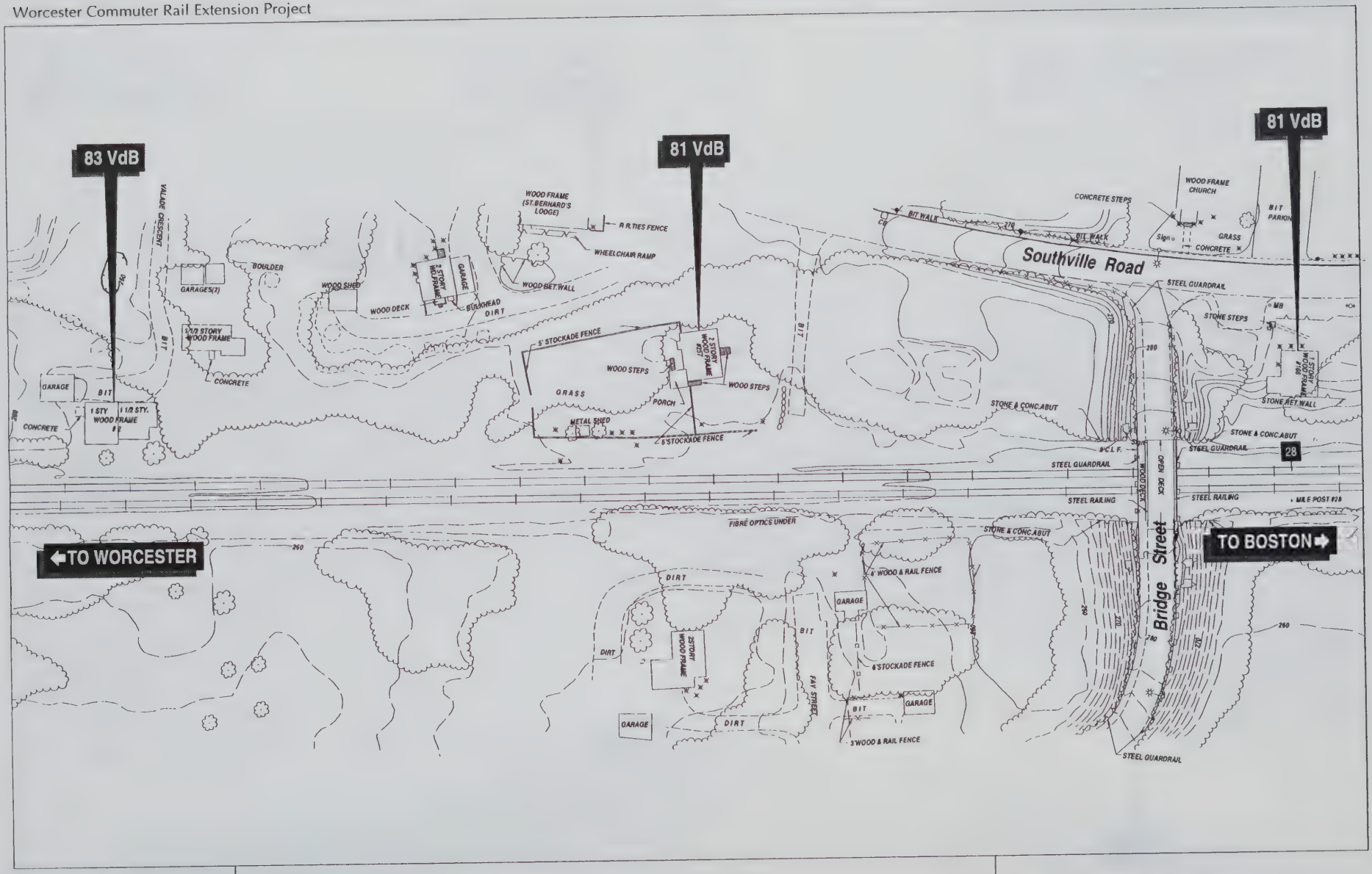
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 100'

0 100'

VIBRATION IMPACTS TOWN OF WESTBOROUGH

FIGURE F-5



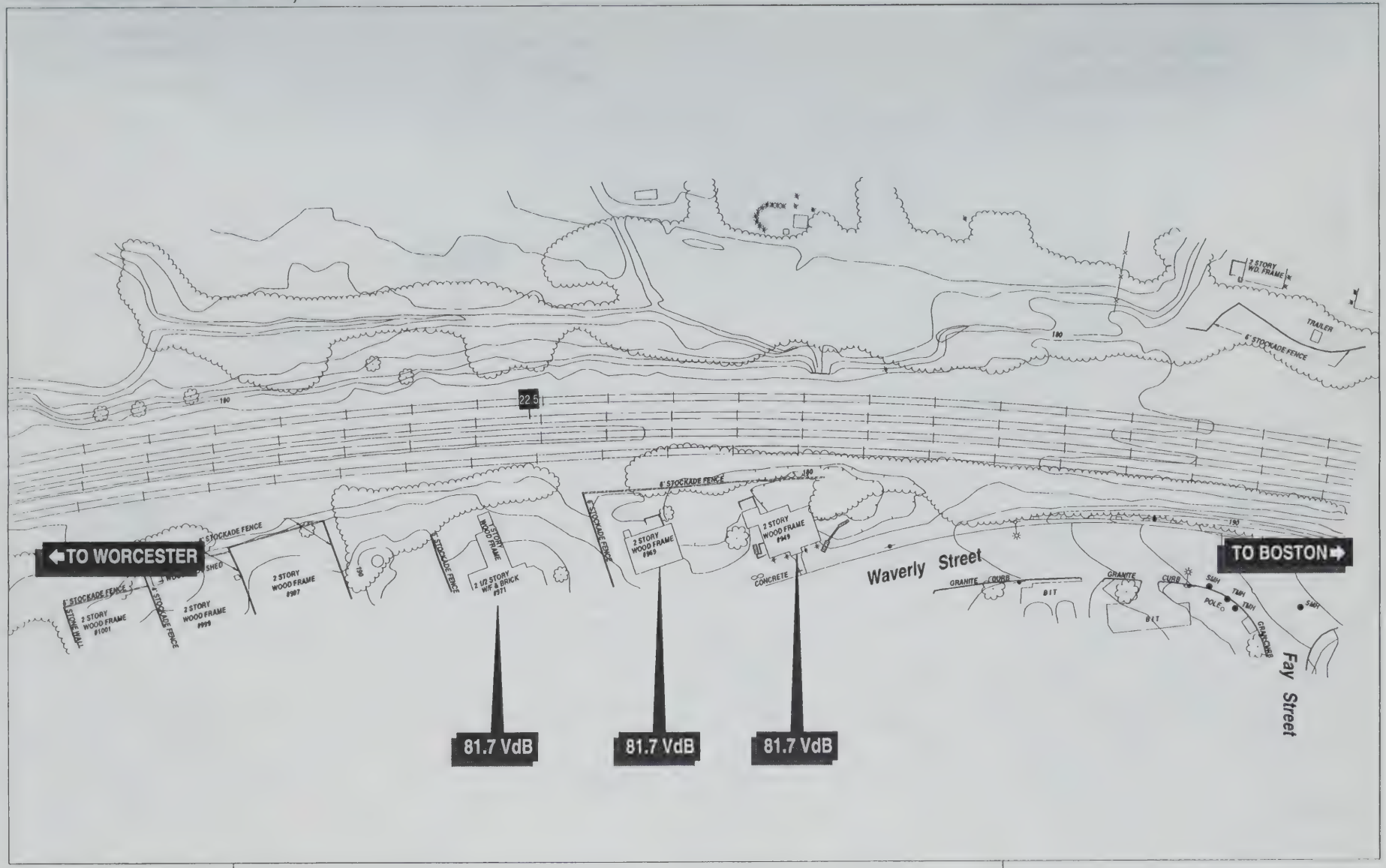
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 100'

0 100'

VIBRATION IMPACTS
TOWN OF SOUTHBOROUGH

FIGURE F-6



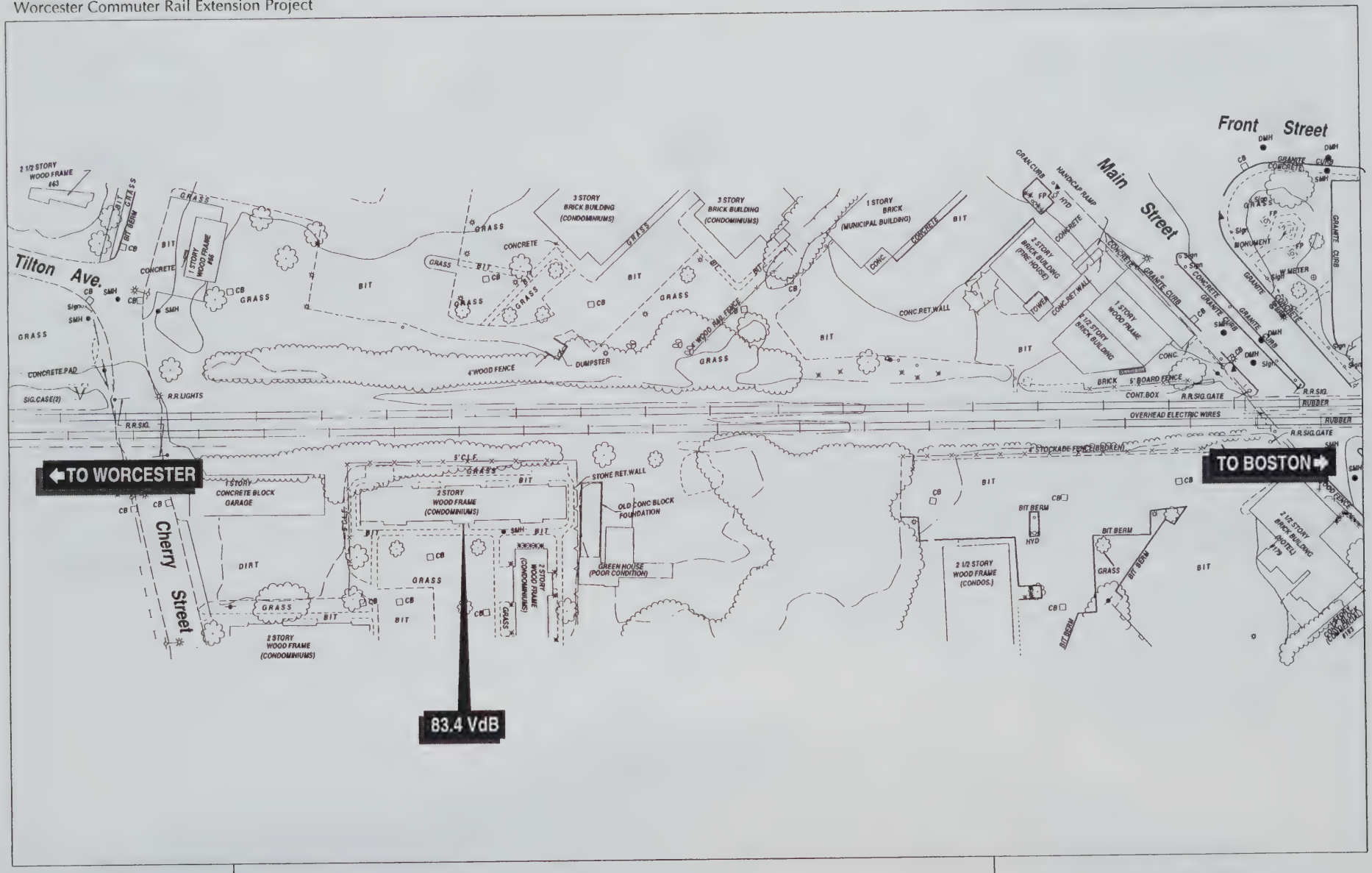
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 100'

0 100'

VIBRATION IMPACTS
TOWN OF FRAMINGHAM

FIGURE F-7



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 100'

0 100'

VIBRATION IMPACTS
TOWN OF ASHLAND

FIGURE F-8

APPENDIX G

AIR QUALITY TECHNICAL MEMORANDUM

Appendix G, Air Quality Technical Support Materials

This appendix provides the technical references identified in the text of Section 5.1. The following are brief descriptions of the tables which follow.

1) **Worcester Commuter Rail Ridership Estimates**. This series of tables provides the ridership estimates for the *All Stations and Only Grafton, Millbury, and Worcester Stations* scenarios for all relevant forecast periods (1996 and 2001). These numbers have been adjusted from person trips to vehicle trips as detailed in the table notes. The ridership estimates are from revised CTPS data which is contained in Appendix D of this FEIR.

2) **Worcester Commuter Rail Distance Measurements**. This series of tables provides the distances, in miles, calculated from regional maps for *Town to Boston* and *Town to Station* trips. Again, all scenarios are accounted for in these tables. Note that there are no differences between 1996 and 2001 since travel patterns and the regional highway network are not expected to change during this period.

3) **Speed Changes on the Massachusetts Turnpike**. These tables present the results of the commuter rail extension on the Turnpike peak hour operations inside Route 128. The base year volumes and segment definitions were taken from the *"High Occupancy Vehicle Lane Feasibility Study,"* prepared by the Massachusetts Turnpike Authority in August 1993 (Revised April 15, 1994). The tables provide the changes in Level of Service, speeds and calculation of VOC, NO_X, and CO emissions.

Worcester Commuter Rail Ridership Estimates

Worcester Commuter Rail Extension Ridership Estimates for Grafton, Millbury and Worcester Stations

Ridership Estimates - Person Trips - Inbound

1996 and 2001

1996

TOWNS:	Grafton	Millbury	Worcester	Total
UPTON	4			4
WESTBORO	7			7
NORTHBORO	13			13
SHREWSBURY	88			88
GRAFTON	39			39
SUTTON	17			17
BOYLSTON	18			18
NORTHBRIDGE	30			30
OXFORD		19		19
CHARLTON		18		18
MILLBURY		28		28
AUBURN		29	19	48
WORCESTER		67	268	335
HOLDEN			58	58
PAXTON			11	11
SPENCER			4	4
LEICESTER			5	5
W.BOYLSTON			35	35
TOTALS:	**216**	**161**	**400**	**777**

2001

TOWNS:	Grafton	Millbury	Worcester	Total
UPTON	5			5
WESTBORO	9			9
NORTHBORO	16			16
SHREWSBURY	96			96
GRAFTON	43			43
SUTTON	18			18
BOYLSTON	19			19
NORTHBRIDGE	32			32
OXFORD		21		21
CHARLTON		19		19
MILLBURY		29		29
AUBURN		35	23	58
WORCESTER		70	280	350
HOLDEN			62	62
PAXTON			12	12
SPENCER			5	5
LEICESTER			5	5
W.BOYLSTON			37	37
TOTALS:	**238**	**174**	**424**	**836**

Notes:

1) Only 85% of person trips translate into auto useage
2) Vehicle Occupancy = 1.12 for trips to Park and Ride and 1.2 for trips to Boston
3) Vehicle Trips (Roundtrip) = Person Trips / 1.12 * 2
4) All Walk to Station Person Trips are subtracted from Vehicle Trips from Station Town
5) All Kiss and Ride trips were assumed to exist with the Station Town and were accounted for as follows:
Vehicle Trips = ((Person Trips - Kiss and Ride)/1.12*2)+(Kiss and Ride/1.12*4)

Ridership Estimates for Trips to Boston - Vehicle Trips - Roundtrip

1996 and 2001

1996

TOWNS:	Grafton	Millbury	Worcester	Total
UPTON	6	-	-	6
WESTBORO	10	-	-	10
NORTHBORO	18	-	-	18
SHREWSBURY	125	-	-	125
GRAFTON	55	-	-	55
SUTTON	24	-	-	24
BOYLSTON	26	-	-	26
NORTHBRIDGE	43	-	-	43
OXFORD	-	27	-	27
CHARLTON	-	26	-	26
MILLBURY	-	40	-	40
AUBURN	-	41	27	68
WORCESTER	-	95	380	475
HOLDEN	-	-	82	82
PAXTON	-	-	16	16
SPENCER	-	-	6	6
LEICESTER	-	-	7	7
W.BOYLSTON	-	-	50	50
TOTALS:	**306**	**228**	**567**	**1,101**

2001

TOWNS:	Grafton	Millbury	Worcester	Total
UPTON	7	-	-	7
WESTBORO	13	-	-	13
NORTHBORO	23	-	-	23
SHREWSBURY	136	-	-	136
GRAFTON	61	-	-	61
SUTTON	26	-	-	26
BOYLSTON	27	-	-	27
NORTHBRIDGE	45	-	-	45
OXFORD	-	30	-	30
CHARLTON	-	27	-	27
MILLBURY	-	41	-	41
AUBURN	-	50	33	82
WORCESTER	-	99	397	496
HOLDEN	-	-	88	88
PAXTON	-	-	17	17
SPENCER	-	-	7	7
LEICESTER	-	-	7	7
W.BOYLSTON	-	-	52	52
TOTALS:	**337**	**247**	**601**	**1,184**

Notes:

1) Only 85% of person trips translate into auto useage
2) Vehicle Occupancy = 1.12 for trips to Park and Ride and 1.2 for trips to Boston
3) Vehicle Trips (Roundtrip) = Person Trips / 1.12 * 2
4) All Walk to Station Person Trips are subtracted from Vehicle Trips from Station Town
5) All Kiss and Ride trips were assumed to exist with the Station Town and were accounted for as follows:
   Vehicle Trips = ((Person Trips - Kiss and Ride)/1.12*2)+(Kiss and Ride/1.12*4)

Ridership Estimates for Trips to Stations - Vehicle Trips - Roundtrip

1996 and 2001

1996

TOWNS:	Grafton	Millbury	Worcester	Total
UPTON	6			6
WESTBORO	11			11
NORTHBORO	20			20
SHREWSBURY	134			134
GRAFTON	85			85
SUTTON	26			26
BOYLSTON	27			27
NORTHBRIDGE	46			46
OXFORD		29		29
CHARLTON		27		27
MILLBURY		62		62
AUBURN		44	29	73
WORCESTER		102	425	527
HOLDEN			88	88
PAXTON			17	17
SPENCER			6	6
LEICESTER			8	8
W.BOYLSTON			53	53
TOTALS:	**354**	**264**	**625**	**1,243**

2001

TOWNS:	Grafton	Millbury	Worcester	Total
UPTON	8			8
WESTBORO	14			14
NORTHBORO	24			24
SHREWSBURY	146			146
GRAFTON	94			94
SUTTON	27			27
BOYLSTON	29			29
NORTHBRIDGE	49			49
OXFORD		32		32
CHARLTON		29		29
MILLBURY		65		65
AUBURN		53	35	88
WORCESTER		106	446	553
HOLDEN			94	94
PAXTON			18	18
SPENCER			8	8
LEICESTER			8	8
W.BOYLSTON			56	56
TOTALS:	**390**	**285**	**665**	**1,340**

Notes:

1) Only 85% of person trips translate into auto useage
2) Vehicle Occupancy = 1.12 for trips to Park and Ride and 1.2 for trips to Boston
3) Vehicle Trips (Roundtrip) = Person Trips / 1.12 * 2
4) All Walk to Station Person Trips are subtracted from Vehicle Trips from Station Town
5) All Kiss and Ride trips were assumed to exist with the Station Town and were accounted for as follows:
   Vehicle Trips = ((Person Trips - Kiss and Ride)/1.12*2)+(Kiss and Ride/1.12*4)

Worcester Commuter Rail Extension Ridership Estimates for All Stations

Ridership Estimates - Person Trips - Inbound

1996 and 2001

1996

TOWNS:	Ashland	Southboro	Westboro	Grafton	Millbury	Worcester	Total
HOLLISTON	279						279
ASHLAND	377						377
SOUTHBORO	23	91					114
HOPKINTON	56	84					140
MARLBORO	35	196					231
UPTON		95	25				120
WESTBORO		41	42				83
NORTHBORO			90				90
SHREWSBURY			64	18			82
GRAFTON				37			37
SUTTON				16			16
BOYLSTON				17			17
NORTHBRIDGE				28			28
OXFORD					17		17
CHARLTON					17		17
MILLBURY					26		26
AUBURN					27	18	45
WORCESTER					62	247	309
HOLDEN						54	54
PAXTON						10	10
SPENCER						4	4
LEICESTER						4	4
W.BOYLSTON						32	32
TOTALS:	**770**	**507**	**221**	**116**	**149**	**369**	**2132**

2001

TOWNS:	Ashland	Southboro	Westboro	Grafton	Millbury	Worcester	Total
HOLLISTON	300						300
ASHLAND	419						419
SOUTHBORO	38	88					126
HOPKINTON	63	78					141
MARLBORO	36	204					240
UPTON		99	26				125
WESTBORO		42	44				86
NORTHBORO			96				96
SHREWSBURY			70	20			90
GRAFTON				41			41
SUTTON				17			17
BOYLSTON				18			18
NORTHBRIDGE				30			30
OXFORD					19		19
CHARLTON					18		18
MILLBURY					27		27
AUBURN					33	22	55
WORCESTER					65	258	323
HOLDEN						58	58
PAXTON						11	11
SPENCER						4	4
LEICESTER						4	4
W.BOYLSTON						34	34
Total	**856**	**511**	**236**	**126**	**162**	**391**	**2282**

Notes:
1) Only 85% of person trips translate into auto useage
2) Vehicle Occupancy = 1.12 for trips to Park and Ride and 1.2 for trips to Boston
3) Vehicle Trips (Roundtrip) = Person Trips / 1.12 * 2
4) All Walk to Station Person Trips are subtracted from Vehicle Trips from Station Town
5) All Kiss and Ride trips were assumed to exist with the Station Town and were accounted for as follows:
Vehicle Trips = ((Person Trips - Kiss and Ride)/1.12*2)+(Kiss and Ride/1.12*4)

Ridership Estimates for Trips to Boston - Vehicle Trips - Roundtrip

1996 and 2001

1996

TOWNS:	Ashland	Southboro	Westboro	Grafton	Millbury	Worcester	Total
HOLLISTON	395	-	-	-	-	-	395
ASHLAND	534	-	-	-	-	-	534
SOUTHBORO	33	129	-	-	-	-	162
HOPKINTON	79	119	-	-	-	-	198
MARLBORO	50	278	-	-	-	-	327
UPTON	-	135	35	-	-	-	170
WESTBORO	-	58	60	-	-	-	118
NORTHBORO	-	-	128	-	-	-	128
SHREWSBURY	-	-	91	26	-	-	116
GRAFTON	-	-	-	52	-	-	52
SUTTON	-	-	-	23	-	-	23
BOYLSTON	-	-	-	24	-	-	24
NORTHBRIDGE	-	-	-	40	-	-	40
OXFORD	-	-	-	-	24	-	24
CHARLTON	-	-	-	-	24	-	24
MILLBURY	-	-	-	-	37	-	37
AUBURN	-	-	-	-	38	26	64
WORCESTER	-	-	-	-	88	350	438
HOLDEN	-	-	-	-	-	77	77
PAXTON	-	-	-	-	-	14	14
SPENCER	-	-	-	-	-	6	6
LEICESTER	-	-	-	-	-	6	6
W.BOYLSTON	-	-	-	-	-	45	45
TOTALS:	**1,091**	**718**	**313**	**164**	**211**	**523**	**3,020**

2001

TOWNS:	Ashland	Southboro	Westboro	Grafton	Millbury	Worcester	Total
HOLLISTON	425	-	-	-	-	-	425
ASHLAND	594	-	-	-	-	-	594
SOUTHBORO	54	125	-	-	-	-	179
HOPKINTON	89	111	-	-	-	-	200
MARLBORO	51	289	-	-	-	-	340
UPTON	-	140	37	-	-	-	177
WESTBORO	-	60	62	-	-	-	122
NORTHBORO	-	-	136	-	-	-	136
SHREWSBURY	-	-	99	28	-	-	128
GRAFTON	-	-	-	58	-	-	58
SUTTON	-	-	-	24	-	-	24
BOYLSTON	-	-	-	26	-	-	26
NORTHBRIDGE	-	-	-	43	-	-	43
OXFORD	-	-	-	-	27	-	27
CHARLTON	-	-	-	-	26	-	26
MILLBURY	-	-	-	-	38	-	38
AUBURN	-	-	-	-	47	31	78
WORCESTER	-	-	-	-	92	366	458
HOLDEN	-	-	-	-	-	82	82
PAXTON	-	-	-	-	-	16	16
SPENCER	-	-	-	-	-	6	6
LEICESTER	-	-	-	-	-	6	6
W.BOYLSTON	-	-	-	-	-	48	48
Total	**1,213**	**724**	**334**	**179**	**230**	**554**	**3,233**

Notes:

1) Only 85% of person trips translate into auto useage
2) Vehicle Occupancy = 1.12 for trips to Park and Ride and 1.2 for trips to Boston
3) Vehicle Trips (Roundtrip) = Person Trips / 1.12 * 2
4) All Walk to Station Person Trips are subtracted from Vehicle Trips from Station Town
5) All Kiss and Ride trips were assumed to exist with the Station Town and were accounted for as follows:
Vehicle Trips = ((Person Trips - Kiss and Ride)/1.12*2)+(Kiss and Ride/1.12*4)

Ridership Estimates for Trips to Stations - Vehicle Trips - Roundtrip

1996 and 2001

1996

TOWNS:	Ashland	Southboro	Westboro	Grafton	Millbury	Worcester	Total
HOLLISTON	423						423
ASHLAND	645						645
SOUTHBORO	35	187					222
HOPKINTON	85	128					213
MARLBORO	53	298					351
UPTON		144	38				182
WESTBORO		62	91				153
NORTHBORO			137				137
SHREWSBURY			97	27			124
GRAFTON				70			70
SUTTON				24			24
BOYLSTON				26			26
NORTHBRIDGE				43			43
OXFORD					26		26
CHARLTON					26		26
MILLBURY					58		58
AUBURN					41	27	68
WORCESTER					94	389	483
HOLDEN						82	82
PAXTON						15	15
SPENCER						6	6
LEICESTER						6	6
W.BOYLSTON						49	49
TOTALS:	**1,242**	**818**	**363**	**190**	**244**	**574**	**3,430**

2001

TOWNS:	Ashland	Southboro	Westboro	Grafton	Millbury	Worcester	Total
HOLLISTON	455						455
ASHLAND	719						719
SOUTHBORO	58	185					243
HOPKINTON	96	118					214
MARLBORO	55	310					364
UPTON		150	39				190
WESTBORO		64	97				161
NORTHBORO			146				146
SHREWSBURY			106	30			137
GRAFTON				77			77
SUTTON				26			26
BOYLSTON				27			27
NORTHBRIDGE				46			46
OXFORD					29		29
CHARLTON					27		27
MILLBURY					61		61
AUBURN					50	33	83
WORCESTER					99	408	507
HOLDEN						88	88
PAXTON						17	17
SPENCER						6	6
LEICESTER						6	6
W.BOYLSTON						52	52
Total	**1,383**	**827**	**389**	**206**	**266**	**610**	**3,681**

Notes:
1) Only 85% of person trips translate into auto useage
2) Vehicle Occupancy = 1.12 for trips to Park and Ride and 1.2 for trips to Boston
3) Vehicle Trips (Roundtrip) = Person Trips / 1.12 * 2
4) All Walk to Station Person Trips are subtracted from Vehicle Trips from Station Town
5) All Kiss and Ride trips were assumed to exist with the Station Town and were accounted for as follows:
Vehicle Trips = ((Person Trips - Kiss and Ride)/1.12*2)+(Kiss and Ride/1.12*4)

Worcester Commuter Rail Distance Measurements

Worcester Commuter Rail Extension Project

Distances from Town Centers to Boston

Worcester, Millbury and Grafton Stations Only (Without Regional Station)

TOWNS:	DISTANCE TO BOSTON: LOCAL:	HWY:	BOSTON:	TOTAL:
UPTON	3.81	32.11	0.75	36.67
WESTBOROUGH	5.19	30.12	0.75	36.06
NORTHBOROUGH	6.38	30.12	0.75	37.25
SHREWSBURY	9.18	30.12	0.75	40.05
GRAFTON	3.46	38.10	0.75	42.31
SUTTON	11.98	38.10	0.75	50.83
BOYLSTON	12.77	30.12	0.75	43.64
NORTHBRIDGE	8.98	38.10	0.75	47.83
OXFORD	6.91	44.40	0.75	52.06
CHARLTON	8.69	44.40	0.75	53.84
MILLBURY	6.09	38.10	0.75	44.94
AUBURN	3.24	44.40	0.75	48.39
WORCESTER	5.55	38.10	0.75	44.40
HOLDEN	13.49	38.10	0.75	52.34
PAXTON	13.88	38.10	0.75	52.73
SPENCER	15.40	44.40	0.75	60.55
LEICESTER	9.49	44.40	0.75	54.64
W.BOYLSTON	15.14	30.12	0.75	46.01
TOTALS:	159.63	671.41	13.5	844.54

Note: All measurements are based on regional maps.

Worcester Commuter Rail Extension Project

Distances from Town Centers to Commuter Rail Stations

Worcester, Millbury and Grafton Stations Only (Without Regional Station)

	DISTANCE TO STATIONS (MILES):											
	GRAFTON			MILLBURY			WORCESTER			AREA	LOCAL	HWY
TOWNS:	LOCAL:	HWY:	TOTAL:	LOCAL:	HWY:	TOTAL:	LOCAL:	HWY:	TOTAL:	TOTALS:	TOTALS:	TOTALS:
UPTON	6.98		6.98							6.98	6.98	0.00
WESTBOROUGH	5.16		5.16							5.16	5.16	0.00
NORTHBOROUGH	7.31		7.31							7.31	7.31	0.00
SHREWSBURY	5.06		5.06							5.06	5.06	0.00
GRAFTON	2.86		2.86							2.86	2.86	0.00
SUTTON	11.45		11.45							11.45	11.45	0.00
BOYLSTON	8.86		8.86							8.86	8.86	0.00
NORTHBRIDGE	8.78		8.78							8.78	8.78	0.00
OXFORD				7.77	6.30	14.07				14.07	7.77	6.30
CHARLTON				9.55	6.30	15.85				15.85	9.55	6.30
MILLBURY				3.51		3.51				3.51	3.51	0.00
AUBURN				4.10	6.30	10.40	3.63	2.30	5.93	16.33	7.73	8.60
WORCESTER				5.43		5.43	1.05		1.05	6.48	6.48	0.00
HOLDEN							8.59		8.59	8.59	8.59	0.00
PAXTON							9.55		9.55	9.55	9.55	0.00
SPENCER							14.46		14.46	14.46	14.46	0.00
LEICESTER							8.73		8.73	8.73	8.73	0.00
W.BOYLSTON							9.05		9.05	9.05	9.05	0.00
TOTALS:										163.08	141.88	21.2

Note: All measurments are based on regional maps.

Worcester Commuter Rail Extension Project				
Distances from Town Centers to Boston				
All Stations, Constrained Parking at Southboro (Without Regional Station				
	DISTANCE			
	TO BOSTON:			
TOWNS:	LOCAL:	HWY:	BOSTON:	TOTAL:
HOLLISTON	10.26	36.25	0.75	47.26
ASHLAND	3.93	23.20	0.75	27.88
SOUTHBORO	2.88	23.20	0.75	26.83
HOPKINTON	7.35	23.20	0.75	31.30
MARLBORO	1.24	33.97	0.75	35.96
UPTON	3.81	32.11	0.75	36.67
WESTBORO	5.19	30.12	0.75	36.06
NORTHBORO	6.38	30.12	0.75	37.25
SHREWSBURY	9.18	30.12	0.75	40.05
GRAFTON	3.46	38.10	0.75	42.31
SUTTON	11.98	38.10	0.75	50.83
BOYLSTON	12.77	30.12	0.75	43.64
NORTHBRIDGE	8.98	38.10	0.75	47.83
OXFORD	6.91	44.40	0.75	52.06
CHARLTON	8.69	44.40	0.75	53.84
MILLBURY	6.09	38.10	0.75	44.94
AUBURN	3.24	44.40	0.75	48.39
WORCESTER	5.55	38.10	0.75	44.40
HOLDEN	13.49	38.10	0.75	52.34
PAXTON	13.88	38.10	0.75	52.73
SPENCER	15.40	44.40	0.75	60.55
LEICESTER	9.49	44.40	0.75	54.64
W.BOYLSTON	15.14	30.12	0.75	46.01
TOTALS:	185.29	811.23	17.25	1013.77
Note: All measurements are based on regional maps.				

Worcester Commuter Rail Extension Project

Distances from Town Centers to Commuter Rail Stations

All Stations, Constrained Parking at Southboro (Without Regional Station)

	DISTANCE TO STATIONS (MILES):																				
	ASHLAND			SOUTHBORO			WESTBORO			GRAFTON			MILLBURY			WORCESTER			AREA	LOCAL	HWY
TOWNS:	LOCAL:	HWY:	TOTAL:	LOCAL:	HWY:	TOTAL:	LOCAL:	HWY:	TOTAL:	LOCAL:	HWY:	TOTAL:	LOCAL:	HWY:	TOTAL:	LOCAL:	HWY:	TOTAL:	TOTALS:	TOTALS:	TOTALS:
HOLLISTON	5.89		5.89																5.89	5.89	0.00
ASHLAND	1.09		1.09																1.09	1.09	0.00
SOUTHBORO	5.30		5.30	4.05		4.05													9.35	9.35	0.00
HOPKINTON	5.16		5.16	7.41		7.41													12.57	12.57	0.00
MARLBORO	9.19		9.19	2.92		2.92													12.11	12.11	0.00
UPTON				12.52		12.52	7.70		7.70										20.22	20.22	0.00
WESTBORO				7.76		7.76	1.68		1.68										9.44	9.44	0.00
NORTHBORO							4.42		4.42										4.42	4.42	0.00
SHREWSBURY							5.62		5.62	5.06		5.06							10.68	10.68	0.00
GRAFTON										2.86		2.86							2.86	2.86	0.00
SUTTON										11.45		11.45							11.45	11.45	0.00
BOYLSTON										8.86		8.86							8.86	8.86	0.00
NORTHBRIDGE										8.78		8.78							8.78	8.78	0.00
OXFORD													7.77	6.30	14.07				14.07	7.77	6.30
CHARLTON													9.55	6.30	15.85				15.85	9.55	6.30
MILLBURY													3.51		3.51				3.51	3.51	0.00
AUBURN													4.10	6.30	10.40	3.63	2.30	5.93	16.33	7.73	8.60
WORCESTER													5.43		5.43	1.05		1.05	6.48	6.48	0.00
HOLDEN																8.59		8.59	8.59	8.59	0.00
PAXTON																9.55		9.55	9.55	9.55	0.00
SPENCER																14.46		14.46	14.46	14.46	0.00
LEICESTER																8.73		8.73	8.73	8.73	0.00
W BOYLSTON																9.05		9.05	9.05	9.05	0.00
TOTALS:																			224.34	203.14	21.2

Note: All measurements are based on regional maps.

Speed Changes on the Massachusetts Turnpike

Worcester Commuter Rail Extension Project
Calculation of Speed Changes on Mass Turnpike Extension

Turnpike Section		Distance	1996 No-Build			1996 Build 2 Station Option			1996 Build 6 Station Option			2001No-Build			2001Build 6 Station Option		
			LOS *	Speed (mph)	Time (sec)	LOS *	Speed (mph)	Time (sec)	LOS *	Speed (mph)	Time (sec)	LOS *	Speed (mph)	Time (sec)	LOS *	Speed (mph)	Time (sec)
Eastbound AM																	
1	Route 128 exit to Toll #15	0.55	C	57	*35*	B	57	*35*	B	58	*34*	C	56	*35*	B	57	*35*
2	Toll #15 to Route 128 Entrance	0.04	C	57	*3*	B	57	*3*	B	58	*2*	C	56	*3*	B	57	*3*
3	Route 128 to West Newton	1.94	E	30	*233*	E	40	*175*	D	47	*149*	F	25 **	*279*	E	43	*162*
4	West Newton to Newton Corner	2.06	F	25 **	*297*	F	25 **	*297*	F	25 **	*297*	F	25 **	*297*	F	25 **	*297*
5	Newton Corner Exit to Entrance	0.54	F	25 **	*78*	E	35	*56*	D	45	*43*	F	25 **	*78*	E	38	*51*
6	Newton Corner to Allston-Brighton	2.74	E	35	*282*	E	43	*229*	D	46	*214*	F	25 **	*395*	E	43	*229*
7	Allston-Brighton Exit to Toll #19	0.35	C	55	*23*	C	55	*23*	C	56	*23*	D	53	*24*	C	55	*23*
8	Toll #19 to Allston-Brighton Entrance	0.19	C	55	*12*	C	55	*12*	C	56	*12*	D	53	*13*	C	55	*12*
9	Allston-Brighton to Pru-Copley	2.2	E	38	*208*	E	44	*180*	D	47	*169*	F	25	*317*	E	40	*198*
10	Pru-Copley to Kneeland	0.92	D	48	*69*	D	50	*66*	D	52	*64*	E	43	*77*	D	50	*66*
Total Distance (miles)		11.53															
Travel Time (seconds)					*1,239*			*1,075*			*1,006*			*1,517*			*1,076*
Average Speed (mph)				33			39			41			27			39	

Turnpike Section		Distance	1996 No-Build			1996 Build 2 Station Option			1996 Build 6 Station Option			2001No-Build			2001Build 6 Station Option		
			LOS *	Speed (mph)	Time (sec)	LOS *	Speed (mph)	Time (sec)	LOS *	Speed (mph)	Time (sec)	LOS *	Speed (mph)	Time (sec)	LOS *	Speed (mph)	Time (sec)
Westbound PM																	
11	Kneeland to Arlington	0.48	C	55	*31*	C	55	*31*	C	56	*31*	C	53	*33*	C	55	*31*
12	Arlington to Clarendon	0.27	D	50	*19*	D	51	*19*	C	53	*18*	D	46	*21*	D	51	*19*
13	Clarendon to Copley	0.19	D	49	*14*	D	50	*14*	D	52	*13*	E	44	*16*	D	50	*14*
14	Copley to Mass Ave	0.51	C	54	*34*	C	55	*33*	C	56	*33*	D	52	*35*	C	54	*34*
15	Mass Ave to Allston-Brighton	1.68	D	51	*119*	D	52	*116*	C	54	*112*	D	48	*126*	D	52	*116*
16	Allston-Brighton to Toll #19	0.22	C	56	*14*	C	57	*14*	C	57	*14*	C	56	*14*	C	57	*14*
17	Toll #19 to Allston-Brighton Entrance	0.28	C	56	*18*	C	57	*18*	C	57	*18*	C	56	*18*	C	57	*18*
18	Allston-Brighton to Newton Corner	2.3	D	49	*169*	D	50	*166*	D	52	*159*	D	46	*180*	D	50	*166*
19	Newton Corner Exit to Entrance	0.36	D	47	*28*	D	49	*26*	D	52	*25*	E	43	*30*	D	50	*26*
20	Newton Corner to West Newton	2.12	F	25 **	*305*	F	25 **	*305*	F	25 **	*305*	F	25 **	*305*	F	25 **	*305*
21	West Newton to Route 128 Exit	1.68	E	33	*183*	E	43	*141*	D	47	*129*	F	25 **	*242*	D	45	*134*
22	Route 128 Exit to Toll #15	0.07	B	57	*4*	B	57	*4*	B	58	*4*	C	57	*4*	B	58	*4*
23	Toll #15 to Route 128 Entrance	0.47	B	57	*30*	B	57	*30*	B	58	*29*	C	57	*30*	B	58	*29*
Total Distance (miles)		10.63															
Travel Time (seconds)					*969*			*918*			*890*			*1,054*			*911*
Average Speed (mph)				40			42			43			36			42	

Levels of service were calculated using 1985 Highway Capacity Software for freeway sections. Level of service is based primarily on flow density and secondarily on speed. The methodology allows evaluation of independent freeway sections and does not account for queuing and spillback between sections which can result in lower speeds.

Input Assumptions:

- Design Speed = 70 mph
- Peak Hour Factor = 0.95
- Heavy Vehicles = 5%
- Lane Width = 12 feet
- Terrain = Level
- Driver Population = Commuter

* Level of Service

** No associated speed can be calculated for LOS F. A speed of 25 mph has been assumed under these conditions.

1/15/96 9:12 AM
Source: E. Peart
Cambridge Systematics

Worcester Commuter Rail Extension Project

Comparison of Emissions Based on Speed Changes on Mass Turnpike Extension

Turnpike Section			1996 No-Build									1996 Build 2 Station Option				1996 No-Build Factors		
		Distance	LOS *	Speed (mph)	Volume	VMT	VOC	NOX	CO	LOS *	Speed (mph)	Volume	VMT	VOC	NOX	CO	VOC	NOX	CO
Eastbound AM																		
1	Route 128 exit to Toll #15	0.55	C	57	3,094	1,702	1,872	4,101	20,794	B	57	2,901	1,596	1,755	3,846	19,499	1,755	3,846	19,499
2	Toll #15 to Route 128 Entrance	0.04	C	57	3,094	124	136	298	1,512	B	57	2,901	116	128	280	1,418	128	280	1,418
3	Route 128 to West Newton	1.94	E	30	5,522	10,713	16,284	18,962	164,552	E	40	5,330	10,339	12,924	18,714	120,039	15,716	18,300	158,811
4	West Newton to Newton Corner	2.06	F	25	6,697	13,796	23,867	24,143	253,574	F	25	6,505	13,399	23,181	23,449	246,279	23,181	23,449	246,279
5	Newton Corner Exit to Entrance	0.54	F	25	5,628	3,039	5,257	5,318	55,856	E	35	5,435	2,935	4,021	5,254	38,770	5,077	5,136	53,944
6	Newton Corner to Allston-Brighton	2.74	E	35	7,215	19,770	27,085	35,388	261,159	E	43	7,023	19,242	22,705	35,213	208,774	26,361	34,443	254,185
7	Allston-Brighton Exit to Toll #19	0.35	C	55	5,405	1,892	2,005	4,332	18,633	C	55	5,212	1,824	1,934	4,177	17,968	1,934	4,177	17,968
8	Toll #19 to Allston-Brighton Entrance	0.19	C	55	5,405	1,027	1,089	2,352	10,115	C	55	5,212	990	1,050	2,268	9,754	1,050	2,268	9,754
9	Allston-Brighton to Pru-Copley	2.20	E	38	7,125	15,674	20,220	28,214	191,227	E	44	6,932	15,250	17,690	27,908	161,959	19,673	27,451	186,055
10	Pru-Copley to Kneeland	0.92	D	48	4,881	4,491	4,895	8,353	44,100	D	50	4,689	4,314	4,659	8,541	42,359	4,702	8,023	42,359
Totals		11.53				72,227	102,710	131,461	1,021,523				70,005	90,046	129,648	866,821	99,576	127,373	990,273
Net Benefit for AM Peak Hour in Kilograms																	10	(2)	123

Turnpike Section			1996 No-Build									1996 Build 2 Station Option				1996 No-Build Factors		
		Distance	LOS *	Speed (mph)	Volume	VMT	VOC	NOX	CO	LOS *	Speed (mph)	Volume	VMT	VOC	NOX	CO	VOC	NOX	CO
Westbound PM																		
11	Kneeland to Arlington	0.48	C	55	3,836	1,841	1,952	4,216	18,135	C	55	3,643	1,749	1,854	4,004	17,224	1,854	4,004	17,224
12	Arlington to Clarendon	0.27	D	50	4,644	1,254	1,354	2,463	12,314	D	51	4,452	1,202	1,298	2,452	11,815	1,298	2,380	11,803
13	Clarendon to Copley	0.19	D	49	4,813	915	997	1,756	8,981	D	50	4,621	878	948	1,738	8,621	957	1,686	8,621
14	Copley to Mass Ave	0.51	C	54	5,601	2,856	3,056	6,341	28,107	C	55	5,408	2,758	2,924	6,316	27,168	2,951	6,123	27,140
15	Mass Ave to Allston-Brighton	1.68	D	51	6,122	10,285	11,108	20,982	101,106	D	52	5,930	9,962	10,659	20,920	97,924	10,759	20,322	97,924
16	Allston-Brighton to Toll #19	0.22	C	56	4,705	1,035	1,118	2,433	11,418	C	57	4,513	993	1,092	2,393	12,132	1,072	2,333	10,951
17	Toll #19 to Allston-Brighton Entrance	0.28	C	56	4,705	1,318	1,423	3,096	14,532	C	57	4,513	1,264	1,390	3,045	15,441	1,365	2,969	13,937
18	Allston-Brighton to Newton Corner	2.30	D	49	6,450	14,835	16,171	28,484	145,684	D	50	6,258	14,392	15,544	28,497	141,332	15,688	27,633	141,332
19	Newton Corner Exit to Entrance	0.36	D	47	4,942	1,779	1,975	3,292	17,793	D	49	4,750	1,710	1,864	3,283	16,791	1,898	3,163	17,099
20	Newton Corner to West Newton	2.12	F	25	6,081	12,891	22,301	22,559	236,933	F	25	5,888	12,482	21,594	21,844	229,425	21,594	21,844	229,425
21	West Newton to Route 128 Exit	1.68	E	33	5,464	9,180	13,127	16,340	128,425	E	43	5,271	8,856	10,450	16,207	96,088	12,664	15,764	123,896
22	Route 128 Exit to Toll #15	0.07	B	57	2,857	200	220	482	2,444	B	57	2,664	186	205	449	2,279	205	449	2,279
23	Toll #15 to Route 128 Entrance	0.47	B	57	2,857	1,343	1,477	3,236	16,407	B	57	2,664	1,252	1,377	3,018	15,301	1,377	3,018	15,301
Totals		10.63				59,732	76,279	115,700	742,279				57,684	71,199	114,166	691,541	73,682	111,689	716,932
Net Benefit for PM Peak Hour in Kilograms																	2	(2)	25
Net Benefit for AM and PM Peak Hours in Kilograms																	**12**	**(5)**	**149**

Worcester Commuter Rail Extension Project
Comparison of Emissions Based on Speed Changes on Mass Turn

Turnpike Section					1996 Build										2001No-Build			
					6 Station Option				1996 No-Build Factors									
	Distance	LOS *	Speed (mph)	Volume	VMT	VOC	NOX	CO	VOC	NOX	CO	LOS *	Speed (mph)	Volume	VMT	VOC	NOX	CO
Eastbound AM																		
1 Route 128 exit to Toll #15	0.55	B	58	2,569	1,413	1,582	3,604	18,932	1,554	3,405	17,265	C	56	3,249	1,787	983	3,162	9,469
2 Toll #15 to Route 128 Entrance	0.04	B	58	2,569	103	115	255	1,377	113	248	1,256	C	56	3,249	130	71	230	689
3 Route 128 to West Newton	1.94	D	47	4,997	9,694	10,761	17,935	96,944	14,735	17,159	148,905	F	25	5,810	11,271	9,918	15,215	121,385
4 West Newton to Newton Corner	2.06	F	25	6,172	12,715	21,996	22,250	233,693	21,996	22,250	233,693	F	25	6,976	14,371	12,647	19,401	154,777
5 Newton Corner Exit to Entrance	0.54	D	45	5,103	2,755	3,169	5,070	28,656	4,767	4,822	50,645	F	25	5,927	3,200	2,816	4,320	34,468
6 Newton Corner to Allston-Brighton	2.74	D	46	6,690	18,331	20,714	33,912	186,977	25,114	32,813	242,153	F	25	7,595	20,809	18,312	28,092	224,115
7 Allston-Brighton Exit to Toll #19	0.35	C	56	4,880	1,708	1,844	4,013	18,838	1,810	3,911	16,822	D	53	5,782	2,024	1,093	3,319	9,775
8 Toll #19 to Allston-Brighton Entrance	0.19	C	56	4,880	927	1,001	2,179	10,226	983	2,123	9,132	D	53	5,782	1,099	593	1,802	5,306
9 Allston-Brighton to Pru-Copley	2.20	D	47	6,600	14,519	16,116	26,860	145,191	18,730	26,134	177,133	F	25	7,623	16,770	14,757	22,639	180,609
10 Pru-Copley to Kneeland	0.92	D	52	4,356	4,008	4,288	8,416	39,396	4,368	7,454	39,356	E	43	5,272	4,850	2,910	6,790	26,820
Totals	11.53				66,173	81,587	124,395	780,230	94,170	120,320	936,361				76,310	64,100	104,971	767,411
Net Benefit for AM Peak Hour in Kilograms									13	(4)	156							

Turnpike Section					1996 Build										2001No-Build			
					6 Station Option				1996 No-Build Factors									
	Distance	LOS *	Speed (mph)	Volume	VMT	VOC	NOX	CO	VOC	NOX	CO	LOS *	Speed (mph)	Volume	VMT	VOC	NOX	CO
Westbound PM																		
11 Kneeland to Arlington	0.48	C	56	3,311	1,589	1,716	3,734	17,528	1,684	3,639	15,652	C	53	4,221	2,026	1,094	3,323	9,787
12 Arlington to Clarendon	0.27	C	53	4,119	1,112	1,190	2,402	10,944	1,201	2,202	10,922	D	46	5,036	1,360	775	1,931	6,908
13 Clarendon to Copley	0.19	D	52	4,288	815	872	1,711	8,009	888	1,564	8,001	E	44	5,210	990	584	1,396	5,316
14 Copley to Mass Ave	0.51	C	56	5,076	2,589	2,795	6,083	28,552	2,770	5,747	25,472	D	52	6,024	3,072	1,659	4,916	14,839
15 Mass Ave to Allston-Brighton	1.68	C	54	5,597	9,403	10,062	20,875	92,528	10,156	19,183	92,434	D	48	6,561	11,023	6,063	15,873	53,021
16 Allston-Brighton to Toll #19	0.22	C	57	4,180	920	1,012	2,216	11,238	993	2,161	10,144	C	56	5,044	1,110	610	1,964	5,881
17 Toll #19 to Allston-Brighton Entrance	0.28	C	57	4,180	1,170	1,288	2,821	14,303	1,264	2,751	12,910	C	56	5,044	1,412	777	2,500	7,485
18 Allston-Brighton to Newton Corner	2.30	D	52	5,925	13,628	14,582	28,618	133,961	14,854	26,165	133,825	D	46	6,809	15,662	8,927	22,240	79,562
19 Newton Corner Exit to Entrance	0.36	D	52	4,417	1,590	1,702	3,340	15,632	1,765	2,942	15,902	E	43	5,227	1,882	1,129	2,635	10,407
20 Newton Corner to West Newton	2.12	F	25	5,555	11,778	20,375	20,611	216,473	20,375	20,611	216,473	F	25	6,346	13,453	11,639	18,161	144,888
21 West Newton to Route 128 Exit	1.68	D	47	4,939	8,298	9,210	15,351	82,976	11,866	14,770	116,084	F	25	5,706	9,587	8,436	12,942	103,249
22 Route 128 Exit to Toll #15	0.07	B	58	2,332	163	183	405	2,187	180	393	1,994	C	57	3,015	211	118	382	1,216
23 Toll #15 to Route 128 Entrance	0.47	B	58	2,332	1,096	1,227	2,718	14,684	1,205	2,641	13,391	C	57	3,015	1,417	793	2,565	8,161
Totals	10.63				54,150	66,213	110,985	649,016	69,202	104,769	673,205				63,205	42,805	90,827	450,720
Net Benefit for PM Peak Hour in Kilograms									3	(6)	24							
Net Benefit for AM and PM Peak Hours in Kilograms									16	(10)	180							

Worcester Commuter Rail Extension Project
Comparison of Emissions Based on Speed Changes on Mass Turn

Turnpike Section			2001 Build									
			6 Station Option							2001 No-Build Factors		
		Distance	LOS *	Speed (mph)	Volume	VMT	VOC	NOX	CO	VOC	NOX	CO
Eastbound AM												
1	Route 128 exit to Toll #15	0.55	B	57	2,681	1,474	826	2,669	8,493	811	2,610	7,815
2	Toll #15 to Route 128 Entrance	0.04	B	57	2,681	107	60	194	618	59	190	568
3	Route 128 to West Newton	1.94	E	43	5,242	10,169	6,102	14,237	56,237	8,949	13,729	109,525
4	West Newton to Newton Corner	2.06	F	25	6,409	13,202	11,618	17,822	142,184	11,618	17,822	142,184
5	Newton Corner Exit to Entrance	0.54	E	38	5,359	2,894	1,910	3,993	18,723	2,547	3,907	31,166
6	Newton Corner to Allston-Brighton	2.74	E	43	7,027	19,254	11,552	26,955	106,474	16,943	25,993	207,364
7	Allston-Brighton Exit to Toll #19	0.35	C	55	5,215	1,825	986	3,139	8,852	986	2,993	8,815
8	Toll #19 to Allston-Brighton Entrance	0.19	C	55	5,215	991	535	1,704	4,805	535	1,625	4,786
9	Allston-Brighton to Pru-Copley	2.20	E	40	7,055	15,521	9,778	21,574	94,056	13,658	20,953	167,160
10	Pru-Copley to Kneeland	0.92	D	50	4,704	4,328	2,380	6,578	20,859	2,597	6,059	23,932
Totals		11.53				69,765	45,746	98,867	461,302	58,702	95,880	703,315
Net Benefit for AM Peak Hour in Kilograms										13	(3)	242

Turnpike Section			2001 Build									
			6 Station Option							2001 No-Build Factors		
		Distance	LOS *	Speed (mph)	Volume	VMT	VOC	NOX	CO	VOC	NOX	CO
Westbound PM												
11	Kneeland to Arlington	0.48	C	55	3,654	1,754	947	3,017	8,506	947	2,876	8,471
12	Arlington to Clarendon	0.27	D	51	4,469	1,207	664	1,882	5,815	688	1,713	6,129
13	Clarendon to Copley	0.19	D	50	4,642	882	485	1,341	4,251	520	1,244	4,737
14	Copley to Mass Ave	0.51	C	54	5,456	2,783	1,503	4,675	13,468	1,503	4,452	13,441
15	Mass Ave to Allston-Brighton	1.68	D	52	5,994	10,070	5,438	16,111	48,636	5,538	14,500	48,435
16	Allston-Brighton to Toll #19	0.22	C	57	4,476	985	551	1,782	5,672	542	1,743	5,219
17	Toll #19 to Allston-Brighton Entrance	0.28	C	57	4,476	1,253	702	2,269	7,219	689	2,218	6,643
18	Allston-Brighton to Newton Corner	2.30	D	50	6,242	14,356	7,896	21,822	69,197	8,183	20,386	72,930
19	Newton Corner Exit to Entrance	0.36	D	50	4,660	1,678	923	2,550	8,086	1,007	2,349	9,277
20	Newton Corner to West Newton	2.12	F	25	5,778	12,250	10,780	16,537	131,928	10,780	16,537	131,928
21	West Newton to Route 128 Exit	1.68	D	45	5,139	8,633	5,007	12,259	45,065	7,597	11,655	92,979
22	Route 128 Exit to Toll #15	0.07	B	58	2,447	171	98	319	1,064	96	310	987
23	Toll #15 to Route 128 Entrance	0.47	B	58	2,447	1,150	656	2,139	7,142	644	2,082	6,625
Totals		10.63				57,171	35,648	86,702	356,051	38,734	82,065	407,799
Net Benefit for PM Peak Hour in Kilograms										3	(5)	52
Net Benefit for AM and PM Peak Hours in Kilograms										**16**	**(8)**	**294**

APPENDIX H

HISTORIC AND ARCHAEOLOGICAL DATA

MEMORANDUM OF AGREEMENT (MOA)

APPENDIX H - HISTORIC AND ARCHAEOLOGICAL RESOURCES

I. CONTEXT FOR ANALYSIS

Prehistoric Context

For most of New England's prehistory, river drainages defined physiographic units within which human communities operated. This pattern follows from the longitudinal diversity of habitats that occurs along drainages, forming ecologically unique wetland habitats, together with the transportation routes afforded by their water courses. In the clearest examples, rivers provided access to maritime and upland resources at each end of the drainage, and to the diverse habitats in between. The exploitation of those habitats can be integrated into a seasonal round that differs at various historical moments.

A review of local evidence for prehistoric occupation for the WCRE project corridor includes:

- Paleoindian: Isolated spot finds in the general region.
- Early Archaic: Sites have been located within the Assabet and Sudbury drainages, for example, along the Hocomonco Pond in Westborough.
- Middle Archaic: Sites have been located within the Cedar Swamp in Westborough, within the Sudbury drainage, Hocomonco Pond, and within the Assabet drainage.
- Late Archaic: An important cluster of sites has been identified within the upland pond (Hocomonco Pond) and wetland (Cedar Swamp and Cold Brook) ecozones; other sites have been identified in upland areas (Flagg Swamp Rock Shelter) and riverine areas (Robin Hill, Davis Pond).
- Woodland Period: This time period is well represented in the Cedar Swamp district as well as within the Assabet and Sudbury drainages.
- Contact Period: Settlement occurred in nearby Chauncy Lake and Hocomonco Pond in Westborough, and oral tradition reports use of Cedar Swamp.

Predictive models for prehistoric site location tabulate known site information according to three variables: flat-to-low slope, well-drained sandy soil, and proximity to water. The combination of these three factors was used to assess the likelihood that prehistoric sites could occur at a given point in the rail corridor.

Historic Context

The first commercial railroad in America was built in Quincy, Massachusetts in 1826 for the purpose of hauling granite by horse car 3 mi. from the Bunker Hill Quarry to the Neponset River. Shortly thereafter, in 1831, the General Court sanctioned the incorporation of the steam-powered Boston & Worcester Railroad as a private stock company. Construction for the Boston & Worcester began in 1832, and the first scheduled passenger train ran between Boston and Newton in April, 1834. The track had reached Westborough by November, 1834, and the line to Worcester opened on the Fourth of July, 1835. When completed, the Boston & Worcester extended 44 1/2 mi. The venture was so successful that in the first six months the train carried 72,558 passengers (an average of 460 a day).

The design requirements for railroads are such that changes in altitude must be gradual, accomplished in part by combinations of cuts into hill slopes and elevated ballast embankments. Wetlands are generally crossed on filled embankments, and streams are either bridged or carried through culverts.

While the route between Boston and Worcester was generally hilly, the line traversed river valleys whenever possible, and no section along the way had an inclination greater than 30 ft. in a mile. The major construction challenge required two 40-ft. cuts through solid rock: one at Cutler's Summit in Grafton, which was 380 ft. above the terminal in Boston, and the other at Worcester Summit, which was 455 ft. above the terminal in Boston.

Two major bridges (one over the Boston Water Power Company and one over the Charles River) were constructed as a part of this line, and the corridor also went over or under 33 public highways and crossed 32 public roads at grade. Masonry bridges were constructed to cross the many small rivers and streams, and wooden bridges on granite abutments were constructed at highway crossings.

II. HISTORIC STRUCTURES

Methodology

The survey of architectural resources performed by Timelines, Inc. for the MBTA's Worcester Commuter Rail Extension project included buildings, structures, objects and other historic cultural resources that are located less than 50 ft. from the center line of the MBTA rail bed in Framingham, Ashland, Southborough, Westborough, Grafton, Millbury and Worcester, Massachusetts. This distance from the center of the railroad is expanded, however, when cohesive groups of buildings, called historic areas, are encountered. At this stage of the project, 42 buildings, 19 bridges and six historic areas have been identified.

These resources were selected for the survey according to guidelines published by the Massachusetts Historical Commission. Criteria included historic merit, architectural or design merit, relationship to neighboring resources, and integrity. Historic merit refers to a building associated with themes or events that represent patterns of local historic development. Buildings have design merit when they are representative of a period, type, style or method of construction as reflected in their design, details, workmanship or are associated with an architect or builder. Relationship to neighboring resources is established when a resource is a contributing element of an historic area, complex or ensemble. A building or structure with historic integrity has suffered little or no damaging alteration to design, structure or materials.

Research Methods

Research concerning architectural resources adjacent to the MBTA rail line from Framingham to Worcester began with a literature search of known historic sites, which established a preliminary context within which to evaluate the existing buildings. A "windshield survey" of structures near the rail corridor provided an opportunity to examine predominant architectural styles, building conditions, and development contexts. The results of these early attempts at

establishing types, styles, locations and conditions of historic resources were reported in the October, 1993 Archaeological Reconnaissance Survey for the Worcester Commuter Rail Extension performed by Timelines, Inc.

Subsequent research emphasized distinctions between pre-1830s and post-1830s land-use patterns in each town. The goal of this stage of research was to establish the relationship between the construction of the railroad from 1831 to 1835 and concomitant land-use changes. The scope-of-work was established in April, 1993 by Timelines and staff of the Massachusetts Historical Commission to include buildings and structures within 50 ft.of the center line of the railroad right-of-way.

Property types determined to be historic included the following:

- Residential structures, consisting mainly of wood-frame, single-family dwellings;
- Industrial structures, consisting mostly of masonry factories located near rail service;
- Railroad-related structures; and
- Bridges, including highway and railroad bridges.

Other structures that are historic and are not among the property types listed above are the National Register-eligible Lloyd's Diner in Ashland and the Grafton State Hospital in Grafton, which is listed in the National Register. The properties indicated by windshield survey and by consultation with the MHC to be historic were then documented through photos and architectural description. This was done in order to record their existing condition and their amount of surviving historic fabric.

National Register Properties

The following is a list of properties that are eligible for or are listed in the National Register of Historic Places and are adjacent to the project area. Eligibility is determined both by the Massachusetts Historical Commission and by Timelines, Inc. staff. Listing occurs either individually or as part of a district. Other properties may be added to this list subsequent to further research.

- **Framingham**

Concord Square Historic District, Framingham	National Register District
Irving Square Historic District. Framingham	National Register District
Framingham Railroad Station, Framingham	National Register Individual Listing
Water Supply System of Metropolitan Boston	National Register Thematic Resource Area
Lloyd's Diner	National Register Eligible

- **Grafton**

State Hospital, Grafton	National Register District

- **Southborough**

Bridge, Bridge Street over MBTA rail line	National Register Eligible
Village of Southville	National Register Eligible
Village of Cordaville	National Register Eligible

- **Westborough**

Westborough Railroad Station	National Register Eligible

- **Ashland**

Bridge, High Street over MBTA rail line	National Register Eligible
Ashland Railroad Station	National Register Eligible
Water Supply System of Metropolitan Boston	National Register Thematic Resource Area

- **Worcester**

Multiple properties in Worcester	National Register Eligible
East Worcester Street Area	National Register Eligible

Other structures may be found to be eligible for inclusion in the National Register as a result of this study.

Contexts of Historic Development

Since the completion of the reconnaissance survey in 1993, several more steps have been taken to complete the intensive survey of historic architecture. Staff members of Timelines, Inc. have attended meetings with the goal of determining contexts in which historic structures adjacent to the railroad may have developed. The contexts were drawn from the historic record of activities taking place in close geographic proximity to the railroad. Some activities occurred within the corridor due to dependence upon availability of transportation. Others provided support to the railroad infrastructure. Some activities may have been located in the survey area because it was the center of population and others were unrelated to the railroad.

Developmental contexts for the WCRE survey area are as follows:

- Architecture/Design
- Commercial
- Industrial/Technological
- Residential
- Community Development
- Civic/Political
- Other Contexts

The Architecture/Design context refers to a building whose existence is justified by the excellence of its design. Buildings that represent expressive and artistic examples of architectural design are the H. H. Richardson train stations in Ashland, Westborough and Framingham. These are works of a master and are eligible for or listed in the National Register of Historic Places. Structures that embody the commercial aspects of rail-related development are important because they housed businesses that provided for the needs of private residents, business and industry. Examples of structures designed for commercial uses are the Ashland Hotel and Fitzgerald's Store in Southborough. Industrial land uses were common along the railroad because of the availability of a transport system for manufactured goods. The Telechron Watch Company Building in Ashland is a well-preserved brick industrial structure that was built near the end of the period dominated by rail transportation.

Residential and community development themes are represented by the many houses found along the railroad. These were built either singly or in cohesive groups, depending on the type and quantity of dwelling units needed. Groups of houses are likely to have been constructed near industrial concerns that had a need to house large numbers of people within a few minutes' travel time of their work place. The mill villages of Cordaville and Southville in Southborough have the most cohesive collection of worker housing. The history of buildings related to the civic and political development of an area is interpreted by explaining the activities of groups they housed. There may be contexts under whose influence structures developed that are not listed above. These will be accounted for as they arise.

Field Research

Timelines staff members have made several field visits through the length of the project area. The purpose of these trips was to determine actual relationships between potentially historic buildings, the railroad, and proposed new construction. Potentially historic buildings that could suffer visual, noise or vibration impacts due to changes made to the rail corridor were noted, and mitigating measures suggested. Another purpose of the field visits was to establish precise locations of buildings with respect to the railroad. This was crucial for performing all tasks contained within the scope-of-work. A third purpose of the field visits was to obtain photographs and information to complete architectural descriptions for MHC Building Inventory Forms.

Historical Research

The influence of the railroad was felt in nearly every aspect of nineteenth-century life and so results in a large number of development contexts that were used to direct the process of historic research. Historic maps that range in date from approximately 1830 to the early twentieth century were helpful resources because they made it possible to gather information concerning the entire survey area at a glance. This information consisted of names of property owners, building materials, footprints, locations, and uses, approximate construction dates, and geographic relationships of building groups.

Written historic materials can also provide insight into activities surrounding historic architecture. Town and city histories provided information about development themes and historic events important to patterns of growth. Corporate histories provided names of factory owners, methods of production, and specific information concerning equipment used by manufacturers.

Numerous reports completed by public agencies and research consultants have also contributed information to the historic narrative component of the survey. Applicable prior research was used where available and noted as such.

Overview and Assessment

Historic background research for the WCRE corridor focused on the role that the railroad played in the history of land use and settlement location within each town. This research emphasis yielded several kinds of conclusions pertinent to the historic architectural development and archaeological potential of the rail corridor. The background research distinguished pre-1830s and post-1830s patterns of land use in each town, and identified both known and potential archaeological resources along the rail corridor for both periods. At the same time, the research framework provided the basis for assessing the historic contexts of both known and expected archaeological resources, and for evaluating the potential significance of these resources once they had been identified in the field.

Following the historic overview for each town is a description of the existing conditions of structures, including residences, industrial and commercial buildings, bridges, and other historic cultural resources adjacent to the WCRE project area. This description includes information about resources surveyed to date that are located within 50 ft. of the center line of the railroad right-of-way or within historic areas that are located in part within 50 ft. of the right-of-way. Impacts to survey properties can be the result of noise, vibration or visual alteration of the railroad. This report utilizes research performed by Timelines' client, Edwards and Kelcey, Inc., to determine impact resulting from noise and vibration as well as a preliminary assessment of fencing impacts. Timelines has performed field research to determine the extent of visual impact to survey properties from rail-related development and has correlated structures impacted by noise and vibration with those considered to be potentially historic. The descriptions are divided by town boundaries. In most cases, bridge alteration and reconstruction was performed by the Massachusetts Highway Department and so was not subject to review. Proposed fence locations were not determined with accuracy and so impacts cannot be pinpointed.

Framingham

After the completion of the railroad in 1835, South Framingham responded to the opportunities offered by rapid rail transportation, becoming the economic and industrial center of town; the former center remained a place of high-status residences (Dewar and Gilbert 1974:8-12, Massachusetts Historical Commission 1980b:1). The railroad stimulated the relocation of older buildings (such as the Town Hall, the High School, and the Centre Bank) from the former town center to South Framingham. The railroad also promoted the growth of the straw-hat industry and the manufacture of boots and shoes. Finally, the railroad opened up new areas for development, such as Harmony Grove near Farm Pond, where religious, social and political events (e.g. Anti-Slavery Society meetings) took place (Dewar and Gilbert 1974:11-12). South Framingham's growth is apparent from statistics, which reveal that the population almost doubled within a decade and a half (Massachusetts Historical Commission 1980b:7-9).

The construction of the Sudbury Aqueduct (ca. 1874-1876) worked in tandem with the rise of the railroad to facilitate the growth of industry. A plentiful and reliable water supply supported

steam-powered industry, and several brick factories were built along the railroad bed at South Framingham and Coburnville (Massachusetts Historical Commission 1980b:7). Industrial structures built at this time included the T. L. Barber straw works on Park Street, just north of the rail line at Farm Pond (Massachusetts Historical Commission 1980b:6). Rows of wooden tenement houses were located south of the railroad bed in South Framingham. To the west of the depot, on the railroad line around Winter Street, the village of Coburnville developed in the late nineteenth century. Here were located the Coburn Boot Co. and the Gregory & Co. boot factory. Two rubber companies, Gossamer Rubber on Waverley Street, and the Para Rubber Shoe Co., (Dennison Manufacturing), were also located in close proximity to the railroad (Massachusetts Historical Commission 1980b:8).

A series of railroad-related structures also sprang up in the vicinity of Farm Pond immediately north of the railroad lines, including a coal shed, a freight house, and an engine house. Following the scheduled stop at the train depot, the locomotives halted at the pond to take in water, which was passed up in pails (Temple 1887:376). At least two fires have damaged these types of railroad structures in Framingham. In 1863, a large railroad storage building caught fire, and in 1865 the depot and a supply of railroad wood burned, along with several railroad buildings. According to contemporary sources, the fire was so hot that "the sleepers burned and the rails curled up like hoop iron" (Dewar and Gilbert 1974:13). Perhaps to lessen the threat of wood supplies' catching fire and damaging wooden railroad structures, the Boston & Albany Railroad erected a series of stone depots in the late nineteenth century. At Framingham, the new stone depot, designed by Henry Richardson, was constructed between 1886 and 1887 and is still standing (Dewar and Gilbert 1974:13).

Historic maps indicate the location of railroad-related sheds and storage structures at the junction of Concord Street and Route 135. These include the Boston & Albany Railroad Hotel, in the northeastern quadrant of the present intersection. Two panoramic views of Framingham reveal additional structures and features (such as a train signal box) along both sides of the tracks by the end of the nineteenth century (Bailey 1882, 1898). These oversize views demonstrate the link between rapid transportation and industry, evident in the number and variety of buildings sited next to the railroad.

Existing Conditions of Survey Structures Adjacent to the Worcester Commuter Rail Extension Project and Review of Impacts Resulting From Noise, Vibration and Visual Effects

Twelve historic buildings and one historic area are located adjacent to the WCRE project area in Framingham. Building uses are industrial, commercial and residential. The majority are on Waverly Street. The historic area is on Fountain Street and includes four buildings. Lloyd's Diner on Fountain Street is also eligible for the National Register in the opinion of the staff of the Massachusetts Historical Commission.

No survey buildings in Framingham have been determined to be subject to impact from train vibration or noise.

Ashland

Despite the presence of mills along the Sudbury River, the economic development of Ashland proceeded slowly prior to the arrival of the railroad. Only the town's hotel and approximately a dozen houses were in close proximity to the station (Works Progress Administration 1942:66). The railroad did stimulate industrial, residential and mercantile growth, with new establishments springing up in the area. (Works Progress Administration 1942:66). One of the new buildings was a railroad station, first built in 1834-35 and replaced by an Italianate-style building in 1850 and again replaced by a granite station in 1888 (Massachusetts Historical Commission 1980a:5-6). To facilitate traffic flow on existing thoroughfares crossed by the railroad, the town constructed several bridges, including the nineteenth-century steel truss bridges at Howe Street and High Street.

One of the outstanding developments in the town was the Cutler Mill site at the border of Ashland and Framingham. Simeon Cutler's large grain business took advantage of both rail transportation and water sources when it adopted steam power and cast-iron machinery in the mid nineteenth century. The site, which contained the first grain elevator east of the Hudson River, was unfortunately part of lands condemned by the City of Boston during the development of the Metropolitan Water Supply system (Works Progress Administration 1942: 73).

Existing Conditions of Survey Structures Adjacent to the Worcester Commuter Rail Extension Project and Review of Impacts Resulting From Noise, Vibration and Visual Effects

Nine survey properties and four bridges are located adjacent to the WCRE project area in Ashland. The bridge at the intersection of High Street and the MBTA rail line has been determined to be eligible for the National Register by staff of the Massachusetts Historical Commission. The location of the Ashland MBTA Station adjacent to the building at 360 Pleasant Street may have a negative impact on that structure.

There are no buildings in the town of Ashland that are anticipated to be impacted by rail-induced vibration or noise.

Buildings on Tilton and Metcalf Avenues, Cherry Street and Pleasant Street may be impacted by the installation of fencing adjacent to the MBTA rail line.

Southborough

The Boston & Albany Railroad reached Southborough by 1834, and fairly soon stimulated industrial development along the Sudbury River in the Southville and Cordaville sections of town. J. Hartt & Co. erected a shoe factory at the junction of the rail line and Main Street, and W. B. Wood owned a series of buildings in the vicinity of the pond at the end of Wood Street. One of these buildings is identified as a satinette factory that manufactured cloth from cotton and wool. By the end of the century, residences surrounded the Southville rail depot, which was razed in 1977 (Noble 1990:336). Bailey's (1887) panoramic view of Southborough provides an excellent plan of late nineteenth-century structures in Southville.

In Cordaville, the link between industrial growth and the railroad was closely associated with one individual. In 1846, Milton Sanford began construction of a large stone mill, designed to manufacture cotton and woollen goods. In addition to the mill, Sanford constructed a company store and residences to house factory workers. Within a year, a mill village existed along the rail line and around a large pond in the Sudbury River. By 1849, the company was incorporated as the Cordaville Manufacturing Company (Massachusetts Historical Commission 1983a:6; Noble 1990:148). Fire destroyed the mill in 1855, but Sanford constructed a replacement factory in the location of the original buildings, where he manufactured wool fabrics and jute blankets. During the Civil War, Sanford supplied jute blankets to the Union Army (Noble 1990:174-175). At an auction in 1928, the site consisted of "two large factories of stone and brick, one four stories and the other three stories in height, two storehouses, and an office building and power plant . . . ." (Stone 1930:1944). According to Richards' 1898 map, the village also contained a train depot, a creamery, and a jail. In 1970, the Cordaville train depot was dismantled and moved to Dublin, New Hampshire, where it became the public library (Noble 1990:336).

Existing Conditions of Survey Structures Adjacent to the Worcester Commuter Rail Extension Project and Review of Impacts Resulting From Noise, Vibration and Visual Effects

There are two National Register eligible areas adjacent to the MBTA rail line in Southborough. These are the Villages of Southville and Cordaville. The areas contain a total of 79 properties. The Bridge Street bridge over the MBTA has been determined to be eligible for the National Register by staff of the MHC. Six other resources have yet to be evaluated for National Register eligibility. One of these is the Route 85 Bridge over the MBTA rail line, which is scheduled for replacement by the MBTA. If the Route 85 Bridge is determined to be eligible for the National Register, it is expected that mitigation might include documentation and review of design for the replacement bridge.

The house at 3 Valade Court in the village of Southville is determined to be subject to impact from train-induced vibration. There are no buildings within the survey area that have been determined to be impacted by noise.

Seven buildings on Southville Road may be impacted by the installation of fencing.

Westborough

The entrance of the railroad into Westborough in 1834 shifted institutional and industrial power back to Main Street and the town square (Allen 1984:32). The village center reemerged as the town's economic base, with commercial, industrial and institutional strength drawn from market access for agricultural products. Westborough milk and cheeses were transported to Boston, in addition to apples from its orchards and pork from its pig farms (Massachusetts Historical Commission 1983b:7). Furthermore, the railroad allowed nineteenth-century manufacturers of straw hats, boots, sleighs, and bicycles to acquire raw materials and transport finished products throughout the country (Allen 1984:54). In facilitating the transportation needs of early industry, the railroad influenced the locations of hotels and taverns, much as the turnpike had done two

decades earlier. Brigham's Tavern, the Westborough Hotel, the Whitney House, Brown's Livery Stable and Ford's Livery Stable all catered to train passengers, and their location was in direct response to the location of the train depot (Allen 1984:57).

The link between railroad location and social and economic institutions is particularly interesting in Westborough. The Boston & Albany railroad tracks originally entered Westborough from Cedar Swamp in the east, and ran parallel to Railroad Street, crossing Main Street at the center of town, and exiting to the west along Milk Street. Because the tracks ran immediately south of the meeting house, which was located at the corner of Main and Summer streets, the town elected to change the meeting house's location. In 1837, the tower and bell were taken down from the building, and the structure became a shopping arcade (Allen 1984:56).

In the mid nineteenth century, a new schoolhouse was constructed on High Street so that children in the Grove Street school catchment area would not have to cross the busy railroad tracks on their way to and from school (Allen 1984:57). The train station was also moved from its former location on Brigham Street (Railroad Street) to its current situation on East Main Street in order to straighten the tracks and increase the train's speed. In addition, the tracks were straightened and elevated where the line crossed the center of town. (The new orientation is overlaid on the 1870 Beers map.) To mollify the fears of local businessmen, rail spurs serviced the freight depot on Brigham Street and sidings ran to factories on Brigham, Union, Beach and Milk streets. Bay State Abrasives was such a profitable freight customer than the company extended tracks into the factory yard (Allen 1984:58). By the end of the nineteenth century, the railroad was firmly embedded in Westborough's economic fabric. The dairy farm of C. Brigham was recognized as the largest milk company in the world by 1890. The Bartlett Box Co. manufactured boxes used by the railroad to ship raw materials and manufactured products to market. Armour & Co. operated a refrigerated warehouse for the storage of meat prior to shipment. From 1914 to 1969, the Westborough Tannery used the railroad system to import sheepskins from New Zealand and Scotland, and kangaroo hides from Australia.

Existing Conditions of Survey Structures Adjacent to the Worcester Commuter Rail Extension Project and Review of Impacts Resulting From Noise, Vibration and Visual Effects

Thirteen survey buildings and five survey bridges are adjacent to the rail line in Westborough. The majority of architectural resources are residential and are located in Westborough Center.

The house at 27 High Street Extension is a survey property that is anticipated to be impacted by railroad vibration. It is eligible for addition to the existing West Main Street Historic District, which is listed in the National Register.

Buildings on Water Street and Union Street may be subject to visual impact from installation of fencing.

Grafton

The opening of the Boston & Albany Railroad did not stimulate industrial growth in Grafton to the same degree evident in Westborough and Southborough. Relatively few structures -- notably the Grafton Station, the J. S. Nelson Shoe Factory, and an engine house -- emerged along the track during its first half century. Built in 1848, the Nelson Shoe Factory's location does not appear to be an immediate consequence of the 1831 railroad (Pierce 1879:359). By the end of the century, however, more structures had been erected along or near the railroad. The Richards 1898 map indicates two factories in the vicinity of the train tracks: the Bay State Ice Company sat on a rail spur near the Millbury town line, while south of the train station, close to the Westborough boundary, was a shoelace manufacturer. Additional structures included the Westborough Savings Bank, immediately south of the tracks on Oak Street, and some railroad-related structures, such as a storage shed, a freight house, and a coal shed. The town's water tower was located just south of the station, at the junction of Oak Street; all the remaining structures were private dwelling houses. Examples of residences along the railroad in New England Village include the Prentice and Warren houses on Oak Street, the Merriam Tenement House, and the J. S. Nelson Factory Worker House. The Worcester State Asylum (known as the Grafton State Hospital after 1915) contained a complex of buildings constructed in 1877, somewhat north of the railroad.

The greatest changes in the town's twentieth-century topography occurred outside the project area, in Farnumsville. Here residential growth took place along Cross Street and east of the mill (Massachusetts Historical Commission 1984a:18). The center of town has changed little since the nineteenth century and is considered one of the best-preserved villages in central Massachusetts (Massachusetts Historical Commission 1984a:2). While Wyman-Gordon Manufacturing provided a new industrial focus northwest of the town center, North Grafton saw only a more intensive in-filling of existing residential and commercial areas (Massachusetts Historical Commission 1984a:18). The project corridor thus retains essentially the same characteristics evident on nineteenth-century maps.

Existing Conditions of Survey Structures Adjacent to the Worcester Commuter Rail Extension Project and Review of Impacts Resulting From Noise, Vibration and Visual Effects

There are two individual survey properties and one historic area containing 10 buildings located adjacent to the MBTA rail line. The existing Grafton State Hospital National Register District is also adjacent to the WCRE right of way.

There are six buildings within the project area that will be impacted by railroad noise. These are located at numbers 3, 5, 7 and 11 Westborough Road, at 13 Elm Street, and on Windle Avenue. The building on Windle Avenue is not historic. There are no buildings that have been determined to be impacted by railroad vibration in Grafton.

There are several historic buildings in Grafton that may be impacted visually by the installation of fencing. The majority are located on Westborough Road near Shrewsbury Street. Others are near the corner of Westborough Road and Institute Road.

Millbury

Development within the town of Millbury was afield of the project area at the extreme northeastern boundary of the town. The entire focus of industrial and residential development occurred along the water routes and overland trails used by the first European settlers. By 1870, the only structure along the rail line was the depot at the junction of the Boston & Albany line and the local Millbury Branch Railroad. By 1878, two structures appeared in connection with the rail line: a "passenger station" and a "depot." Upgrading and widening town and state roads improved the routes from Worcester to Providence, from Worcester to Grafton and from Worcester to Sutton in the twentieth century. All these routes traversed the town south of the project area, further isolating the northeast portion of the town (Massachusetts Historical Commission 1989:16).

Existing Conditions of Survey Structures Adjacent to the Worcester Commuter Rail Extension Project and Review of Impacts Resulting From Noise, Vibration and Visual Effects

No survey properties are located near the MBTA rail line as it passes through Millbury.

Worcester

The impetus for the mid nineteenth-century industrial boom in Worcester came not only from transportation developments, but from an allied industrial invention -- the steam engine. Not only did steam power passenger and freight trains, it also mitigated the effect of an absence of water power on Worcester's economic base (Farnsworth and O'Flynn 1934:133-134). Stephen Salisbury II was quick to exploit the entrepreneurial potential of steam by renting both steam-powered machinery and factory buildings to small businesses and individual mechanics (Massachusetts Historical Commission 1984b:14). A series of factories operating under the rental system opened along the Western, and Norwich & Worcester rail corridors to the south and west of the original manufacturing district at Lincoln Square. Rental factories included the Merrifield Building along Union Street, the Red Mill at the junction of Green and Water streets, and the Junction and Lower Junction shops near the intersection of Southbridge and Sargent streets. By the 1850s, a variety of manufacturers coexisted in a vigorous industrial climate: machine-tool, water-wheel, and metal manufacturers, textile and wood-working machinery makers, a woolen mill, and a cast-iron foundry (Massachusetts Historical Commission 1984b:14).

Despite this nineteenth-century industrial growth along rail lines and the Blackstone Canal, development was far less intensive along the WCRE project corridor to the east of the city center. Beers (1870) shows few structures located along the Boston & Albany rail corridor between Worcester and Millbury. Exceptions include the Wm. Eaton Brick Yard near Bloomingdale Street. Some industrial structures stood closer to the town center and are directly related to the railroad. These include buildings in the Boston & Albany Yards on Bloomingdale Street. They also include a coal elevator and a grain elevator at the corner of Grafton Street and Bloomingdale Street, in addition to Boston & Albany Railroad sheds located near Lyon and East Worcester streets (Richards 1898). This configuration remained essentially unchanged in the early twentieth century, with the exception of a coal-company structure, a lard works along the rail corridor near Putnam Lane, and some small dwellings near the intersection of Aitcheson and Plantation streets

(Richards 1911). The apparent lack of structures along the tracks to the east of the city may signify that the area was dedicated to agricultural uses. The City of Worcester had more tilled acres and higher vegetable production than any other town in Worcester County by the end of the Early Industrial Period. (Massachusetts Historical Commission 1984b:16). East of the city, there were farms and land use was predominantly agricultural.

Existing Conditions of Survey Structures Adjacent to the Worcester Commuter Rail Extension Project and Review of Impacts Resulting From Noise, Vibration and Visual Effects

The City of Worcester is the site of several survey properties that are near the MBTA rail line. An area of 15 late nineteenth- and early twentieth-century brick industrial buildings and some wood-frame residences located on East Worcester Street has been determined to be eligible for the National Register. Although this is an industrial complex that bears a long association with the railroad, large-scale modern construction of a rail layover facility may compromise the historic integrity of the area. In order to mitigate these effects, new construction should be kept below the height of existing nearby structures to mitigate any negative effects therefrom. Five other survey buildings are adjacent to the project area.

No survey buildings in Worcester are determined to be impacted by rail-induced vibration or by noise.

Table 1: Survey Properties Impacted by Construction in Framingham, Ashland, Southborough, Westborough, Grafton, and Worcester.

Town	Address/ Location	Property Name	National Register Status	Impact Type	Mitigation
Ashland	15 Metcalf Street		Not eligible	Visual	Historically appropriate fence/landscape
Ashland	55 Tilton Street		Not eligible	Visual	Historically appropriate fence/landscape
Ashland	60 Pleasant Street		Not eligible	Visual	Historically appropriate fence/landscape
Ashland	80 Cherry Street		Not eligible	Visual	Historically appropriate fence/landscape
Southborough	3 Valade Court		Eligible only in a district	Vibration, visual	Equipment maintenance, historically appropriate fence/landscape

Southborough	Route 85 over MBTA	Route 85 Bridge	Eligible only in a district	Removal visual	Documentation; replacement design review; historically appropriate fence/landscape
Southborough	2 Valade Court		Eligible only in a district	Visual	Historically appropriate fence/landscape
Southborough	160 Southville Rd.		Eligible only in a district	Visual	Historically appropriate fence/landscape
Southborough	162 Southville Rd.		Eligible only in a district	Visual	Historically appropriate fence/landscape
Southborough	166 Southville Rd.		Eligible only in a district	Visual	Historically appropriate fence/landscape
Southborough	100 Southville Rd.		Eligible only in a district	Visual	Historically appropriate fence/landscape
Southborough	98 Southville Rd.		Eligible only in a district	Visual	Historically appropriate fence/landscape
Westborough	Union Street	Richardson Rail Station	Eligible	Visual	Historically appropriate fence/landscape
Westborough	38 Water Street		Not eligible	Visual	Historically appropriate fence/landscape
Westborough	46 High Street Ext.		Not eligible	Visual	Historically appropriate fence/landscape
Westborough	27 High Street Ext.		Eligible as a boundary increase	Vibration, visual	Equipment maintenance; historically appropriate fence/landscape
Grafton	3 Westborough Rd.		Not eligible	Noise, visual	Historically appropriate fence/landscape
Grafton	5 Westborough Rd.		Not eligible	Noise, visual	Historically appropriate fence/landscape
Grafton	7 Westborough Rd.		Not eligible	Noise, visual	Historically appropriate fence/landscape

Grafton	11 Westborough Rd.		Not eligible	Noise, visual	Historically appropriate fence/landscape
Grafton	109 Westborough Rd.		Not eligible	Visual	Historically appropriate fence/landscape
Grafton	Windle Ave.		Not eligible	Noise, visual	Historically appropriate fence/landscape
Grafton	Elm Street		Not eligible	Noise, visual	Historically appropriate fence/landscape
Grafton	Pine Street	Grafton State Hospital National Register District	National Register District	Visual	Design sensitive to NR district
Worcester	East Worcester	East Worcester Street Public Works Area	Eligible	Visual	Maintain low height of proposed buildings

III. ARCHAEOLOGICAL RESOURCES

Reconnaissance or Background Research Study

When the existing track was first laid in the 1830s, there was considerable impact to existing archaeological sites, both prehistoric and historic. Since that time, additional historic structures have appeared along the rail line. Various components of the WCRE project have been evaluated for their potential impacts on pre-railroad prehistoric and historic archaeological sites, as well as on subsequently formed historic archaeological sites.

As part of a reconnaissance survey of the WCRE right-of-way (ROW) (Edens et al. 1995), a walkover survey of the rail corridor was conducted in order to identify archaeological (prehistoric and historic) resources exposed on the surface of the rail corridor, and to gain information useful in modeling the probability that subsurface archaeological resources exist in the rail corridor. Following the walkover phase of this survey, the WCRE project corridor was divided into segments according to obvious features such as road crossings, utility easement crossings, and river crossings. Each of the segments contained subsegments, defined by observed variation in topography and disturbance. The cartographic information on slope, soils, and distance from water was factored into these segments, to produce zones of prehistoric archaeological potential resulting in a predictive model that will be useful in defining level-of-effort for more detailed studies. Historic maps and town histories were studied for references to the location of early residential, industrial, and commercial structures in order to generate a predictive model of historic archaeological potential. Predictive models used the background research and walkover results to create a sensitivity ranking along the edges of the linear rail corridor.

Three overall sensitivity ratings were developed, each implying different cultural-resource survey recommendations. Sensitivity rating I reflected an area with a high probability of containing a site, sensitivity rating II reflected an area with a moderate probability of containing a site, and sensitivity rating III reflected an area with a low potential for containing a site. It was recommended that areas with a high-to-moderate sensitivity rating be subjected to an intensive archaeological survey, if they were to be impacted by construction as defined in the final project design. Areas with a low potential required no further archaeological investigations. The following is a summary of the archaeological sensitivity ratings along the line:

Table 2: Survey Segments Listed by Archaeological Sensitivity Rating (see Fig. 1).

	I	II	III
Segment 1			All
Segment 2		e-f, h	a-d, g
Segment 3		i	a-h, j-k
Segment 4	e, g^n	d, g^s, m	a-c, f, h-l, n
Segment 5	b, d-e, g^n	f, h, i^n, j	a, c, g^s, i^s
Segment 6	a, b^s, f-g, j	c-d, i	b^n, e, h,
Segment 7	b^s	a	b^n, c-i
Segment 8	e-f, h^n, i	l, m	a-d, g, h^s, j-k
Segment 9	e, f^n, g, l, k^s, l^s	p	a-d, f^s, h, j, k^n, l^n, m-o
Segment 10	a-b, d-e, f^n		c, e, f^s, g
Segment 11	c^n, d, e^n, f, g^n, i^n	b, h,	a, c^s, e^s, g^s, i^s
Segment 12	e-f, g^n	b, g^s, k	a, c-d, h-j, l
Segment 13	f, g^n, h^n		a-e, g^s, h^s, i-o

Segments with different sensitivity ratings on each side of the rail corridor, and therefore listed twice, are distinguished by superscripts n(orth) and s(south) to indicate the side of the corridor to which the rating applies.

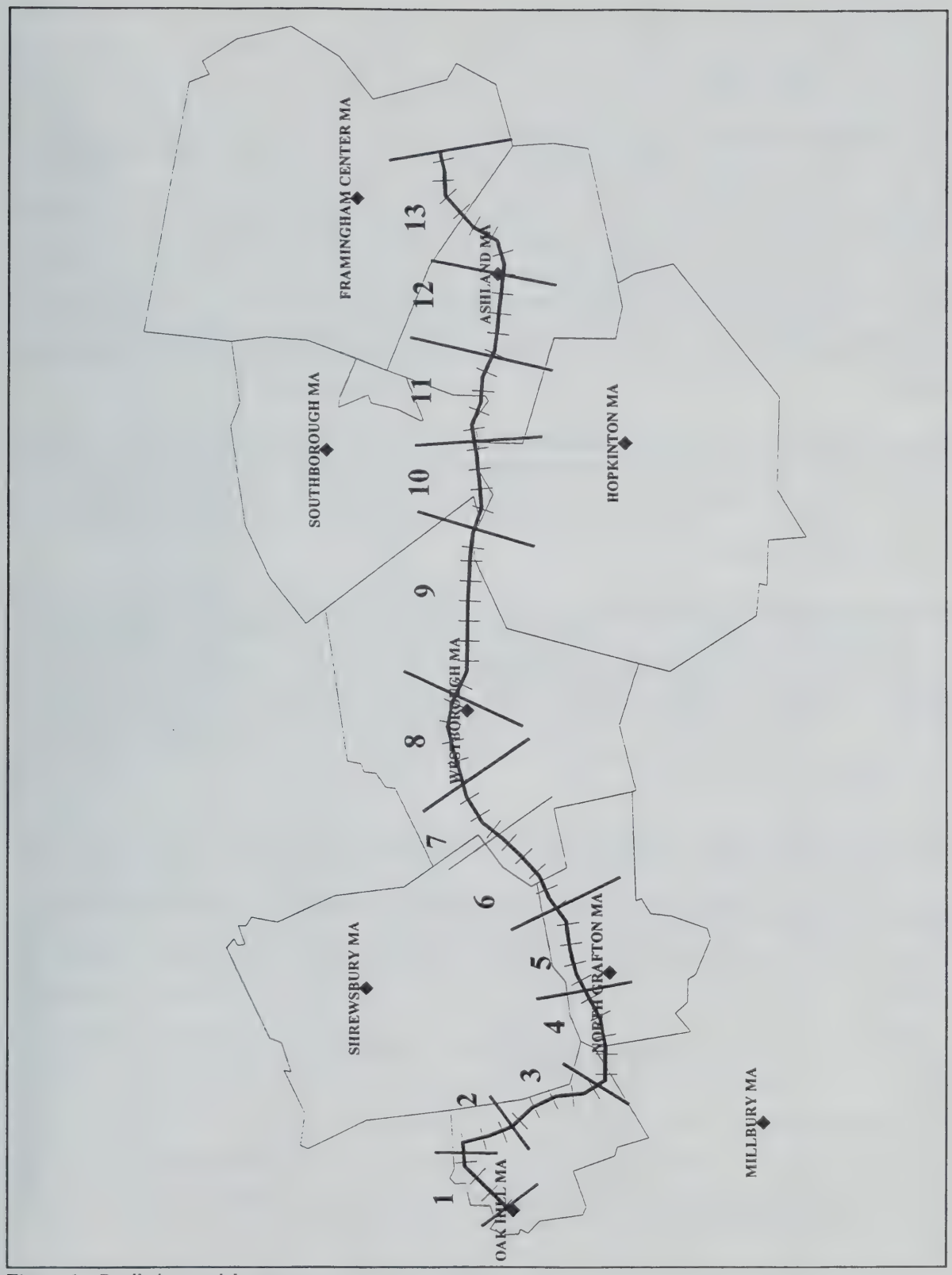


Figure 1 - Predictive model segments.

Intensive or Site-Location Study

Right-of-Way

The recommendations from the reconnaissance survey initiated an intensive (locational) survey (950 CMR 70), along the rail corridor where a second mainline track will be constructed between Mile Post (MP) 40 in Worcester and MP 33 in Westborough (beginning at subsegment 3i in Worcester and ending at subsegment 7c in Westborough in the reconnaissance survey). While the construction of the second track along this section of the rail corridor will not disturb the embankment along the entire ROW, there are some sections considered to have a high or moderate potential for containing archaeological sites, whether prehistoric or historic, that will be impacted (Thomas K. Dyer, Inc. 1994). In order to facilitate the construction schedule for this component of the project, the intensive survey for MP 40 to MP 33 was conducted in August of 1995.

Archaeological field work consisted of placing linear transects in the zones identified as having high or moderate archaeological potential and where ground-moving subsurface disturbance is to occur. Field work was conducted in subsegments 3i, 4d/e, 6a, 6c, and 7a to determine the presence of prehistoric or historic sites that would be affected by either narrow or deep cuts within the rail embankment.

The results of the intensive survey indicated that the construction of the Boston & Worcester Rail Line in the 1830s impacted the entire rail corridor within the confines of MP 40 and MP 33. The extensive cutting and filling carried out to minimize grades on the rail line, to provide wetland crossings on filled embankments, and to create bridges or culverts for streams resulted in extensive disturbance. Because no prehistoric materials were found, the historic materials recovered were from the modern period, and every subsegment was found to be disturbed, no additional testing is recommended.

Table 3: Test Results.

Segment	Sensitivity	Length of Subsegment	No. of Test Pits	Resources Discovered?
3i	II	300 ft./90 m.	9	No
4d & 4e	I	300 ft./90 m.	9	No
5d & 5e	I	1620 ft./495 m.	50	No
6a	I	200 ft./60 m.	7	No
6c	II	300 ft./90 m.	9	No
6j	I	400 ft./120 m.	12	No
7a	I	900 ft,/275 m.	27	No

The second phase of intensive archaeological study is related to those areas of high-to-medium potential that will be impacted through the construction of fencing. Chain-link fencing will be erected along certain portions of the rail corridor that have been judged critical to safety and security. At the same time, the need to allow wildlife crossing limits the extent of the fencing. The construction of fences involves fairly narrow bands of disturbance at the edges of the existing rail line, and will potentially expand the zone of existing disturbance.

Of the new fencing planned in the final design, only three sections fall in moderate- or high-sensitivity areas as defined in the archaeological reconnaissance study. These are MP 37.1 (Grafton), 28.0 (Southborough), and 27.1 (Southborough). After a visual reassessment of the fencing's locations, evaluation of the three fencing areas will continue with systematic transects (at 6-m. intervals) of sampling with a hand-held soil probe. The locations shown by these soil probes to be disturbed will not be tested further. If undisturbed sections exist, subsurface testing will be performed using single transects of shovel test pits.

As shown in the table, the systematic testing effort for the fencing area will therefore approximate 50 test pits. Additional test pits may be placed around pits that contain prehistoric or early historic artifacts.

Table 4: Remaining intensive survey test pits.

Place	Length	Side of Track	Archaeo-logical. Segment	Testing Interval	No. of Test Pits
MP 37.1	105 m.	S	5f	20 m.	7
MP 28.0	120 m.	N, S	10e	12 m.	20
MP 27.1	280 m.	N	11c	12 m.	23

In order to allow for one comprehensive report to be generated for the WCRE project along the ROW, as recommended by the Massachusetts Historical Commission (MHC), Timelines, Inc. will submit the final report upon completion of the intensive archaeological survey for the remainder of the ROW.

Testing in the fence impact zones has been delayed due to weather.

Worcester Layover Facility

As part of the WCRE project, a layover facility is proposed at the existing rail yard east of the Amtrak Worcester Station at MP 43.5. Such facilities typically are provided at the outer terminus of a commuter rail line in order to eliminate non-revenue runs back to a central facility at night. This site will accommodate four train sets with the necessary support facilities (an electrical substation, a maintenance building, a compressor house, and associated access driveways and employee parking).

Located in Segment 1as defined by the reconnaissance survey report, the Layover Facility is in an area of low archaeological potential. No testing is recommended.

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Massachusetts Historical Commission
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PROPOSED
PROCESS MEMORANDUM OF AGREEMENT

WHEREAS, the Worcester Commuter Rail Project (the Project) may have an effect upon historic and archaeological resources under regulations for their protection implementing M.G.L. Chapter 9, ss. 26-27C, as amended; and

WHEREAS, the Massachusetts Bay Transportation Authority (MBTA), the Project proponent, has undertaken certain historic and archaeological investigations associated with the environmental impact review of the Project pursuant to the Massachusetts Environmental Policy Act (MEPA) (M.G.L. Chapter 30, ss. 61-62H), but not been able to complete such investigations prior to the Final Environmental Impact Report (FEIR) submission; and

WHEREAS, the MBTA has consulted with the Massachusetts Historical Commission (MHC) and proposed an alternative procedure to the FEIR review to resolve outstanding issues concerning possible ways to avoid, minimize or mitigate effects from the Project on historical and archaeological resources; and

WHEREAS, the MHC has accepted the MBTA's proposal for an alternative procedure;

NOW THEREFORE, the MBTA and the MHC agree that the outstanding historic and archaeological issues associated with the Project shall be resolved in accordance with the following stipulations in order to take into account, and avoid, minimize or mitigate as necessary the possible effects of the Project on historic properties and archaeological resources.

STIPULATIONS

The MBTA will ensure that the following measures are carried out:

A. Historic Resources

1. Survey Completion

The MBTA shall complete the survey of historic properties along the project right-of-way including proposed station sites. The survey results shall be submitted to the MHC for review and for a determination of consistency with the Secretary of Interior Standards for Archaeology and Historic Preservation. The MHC shall apply the National Register criteria of eligibility and criteria of effect. The MBTA shall consult with the MHC regarding how to mitigate for any adverse effects of the Project on National Register eligible properties.

2. *Mitigation Contingencies*

a. Vibration. Vibration mitigation options were examined in the November 1994 Draft Environmental Impact Report (DEIR) and in the July 1995 FEIR where it was determined that the most feasible and cost effective vibration mitigation related to railroad operations for the Project will involve properly maintaining the project's associated rolling stock.

b. Noise. A determination whether to construct noise barriers to mitigate Project impacts will include consideration of possible visual impact of said barriers on an existing or potentially eligible historic district.

c. Visual. To minimize visual impact on historic resources of the Project, sensitive landscaping elements will be incorporated in consultation with MHC. Minimization of visual impact of fencing required by the Project for public safety purposes shall include consideration of alternative fencing materials and landscaping.

3. *Design of Grafton Station.*

In order to minimize the visual impact of the proposed Grafton station, the MBTA shall provide proposed Grafton station site plans and elevation drawings to MHC for review and approval prior to commencing construction of the Grafton station. The Grafton station design may include the following elements and possibly others, to minimize any impact on the Grafton State Hospital National Register District:

a. Tree removal will be limited to the extent feasible, for visual buffer and to preserve the rural look of the site.

b. The pedestrian overpass design shall be as visually non-obtrusive as is feasible.

c. Landscaping will be designed to mitigate visual impacts of the parking area and structures.

4. *Reconstruction of Route 85 Bridge*

Located in Southborough, this railroad bridge is located within the Cordaville district which has not been listed, but appears to be eligible for listing on the National/State Registers of Historic Places as part of a district. The existing bridge must be removed and a replacement bridge will be constructed.

The MBTA shall consult with the MHC regarding the proposed demolition and if requested, shall provide an analysis alternative(s) to the demolition and adequate documentation prior to demolition, as required.

Further, the MBTA shall provide preliminary design plans and elevation drawings of the replacement bridge to MHC, allowing MHC to comment on the plans and drawings prior to commencement of construction. Recommendations of the MHC regarding the reconstruction of the replacement bridge shall be weighed heavily by the MBTA in determining its ultimate design.

B. Archaeological Resources

1. Archaeological Testing.

The MBTA shall ensure that no construction activities, including site preparation and geotechnical and environmental testing, shall occur in any area where archaeological testing has been deemed necessary prior to consulting with the MHC.

2. Fencing and Station Sites.

For any areas where fencing is proposed and where station sites are proposed, the MBTA shall, beforehand, complete the area's archaeological testing. Results of archaeological testing shall be submitted to the MHC for review and consistency with 950 CMR 70 and with the Secretary of Interior Standards for Archaeology and Historic Preservation. The MHC shall apply the National Register criteria of eligibility and criteria of effect. Should the testing results show that areas contain significant archaeological resources, the MBTA shall consult with the MHC on ways to avoid, minimize or mitigate impacts to archaeological resources.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

By: _____ Date_____
Patrick J. Moynihan
General Manager

MASSACHUSETTS HISTORICAL COMMISSION

By: _____ Date_____
Judith B. McDonough
State Historic Preservation Officer/
Executive Director

APPENDIX I

TRAFFIC DATA

Introduction

The traffic data contained in Appendix I is for the Framingham Station area streets. The traffic data for the Millbury and Grafton Stations are included in Appendix - Volume I which was distributed with the November 1994 DEIR.

APPENDIX I

TRAFFIC DATA
FRAMINGHAM STATION

Project Introduction

Framingham station is located within the downtown area at the northwest quadrant of Concord Street (Route 126) and Waverly Street (Route 135) intersection. It has been in existence for more than hundred years, and is classified a historical site. The MBTA is in the process of upgrading the station under a separate MEPA review (EOEA #10106). The proposed improvements were to address commuter safety and accessibility, track operations, and commuter parking. Figure I-1 shows a locus map of the Framingham Station.

The station is near a roadway network that is highly congested due to the high volume of traffic traveling through the downtown.

The proposed station platforms will be extended westerly to accommodate the desired length of trains. The main building will be retained, and additional pedestrian crossing will be provided.

Wheelchair access will be provided to the station, the parking area, and platforms. Access configuration will comply with ADA requirements. The new parking facilities will contain designated handicap parking spaces.

The grade crossing at the Route 126/Route 135 intersection will be maintained, and steps will be taken to improve safety. The existing traffic signal system at the intersection is outdated and does not conform to applicable state and federal standards. A new traffic responsive system can improve the operational capacity and pedestrian safety.

Under Phase I of the Framingham project, 95 parking spaces will be constructed in the "Y" parcel south of Waverly Street, and the 48 parking spaces off Waverly Street will

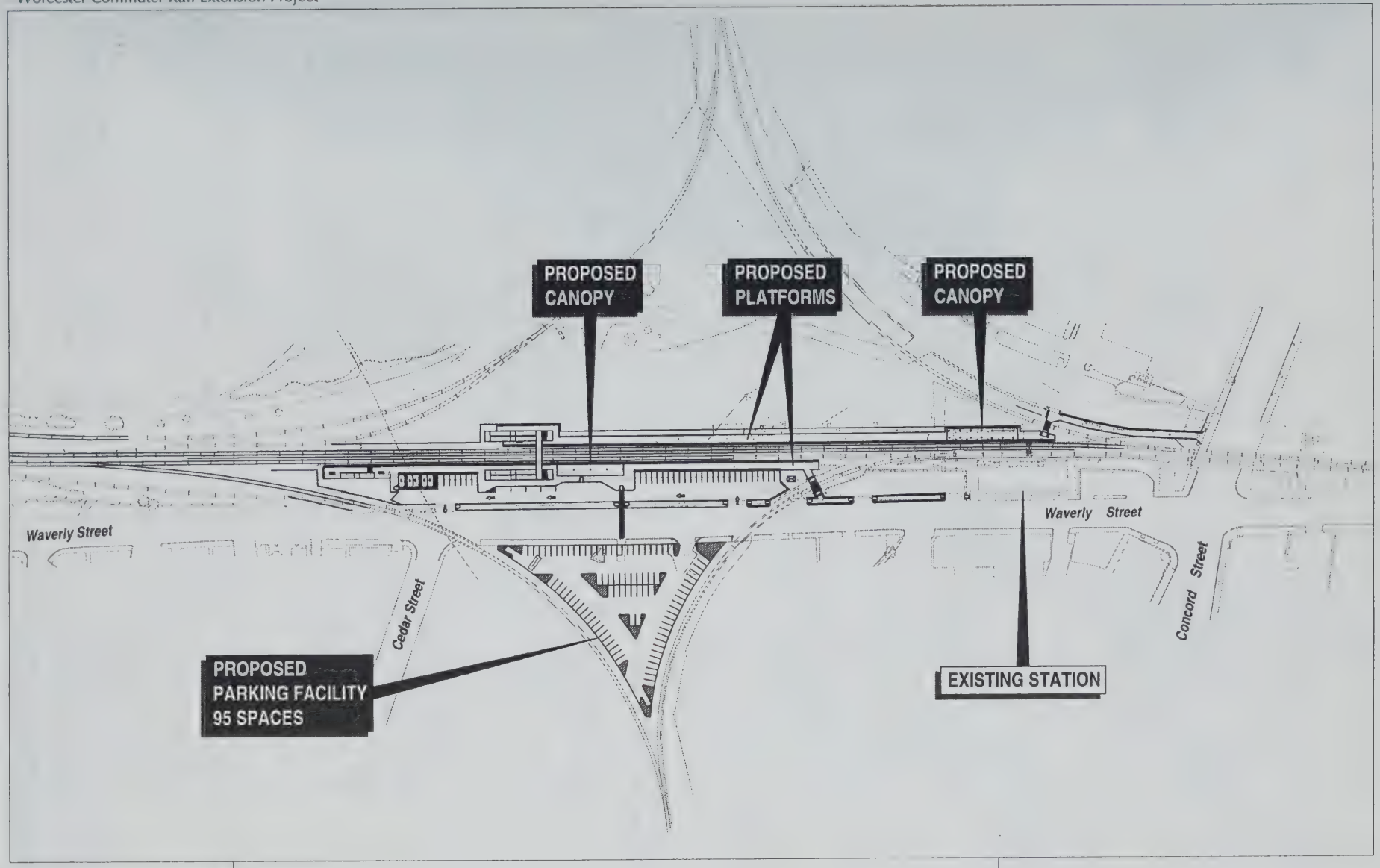
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

0 2000

LOCUS MAP
FRAMINGHAM STATION

FIGURE I-1



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 200'

0 200

SITE PLAN
FRAMINGHAM STATION

FIGURE I-2

increase to 50 spaces with an improved passenger drop off area. Under Phase 2 of the project, an additional 350 commuter parking spaces could be constructed (if necessary) in the Conrail north yard immediately north of the station platforms. Figure I-2 shows a site plan of proposed facility and parking.

Study Area

Traffic evaluation and analysis for Framingham Station focused on two existing signalized intersections on Route 126 north and south of the station tracks and the Route 126 grade crossing. The intersections and controls are under the town's jurisdiction. The town will be maintaining the roadway and traffic controls.

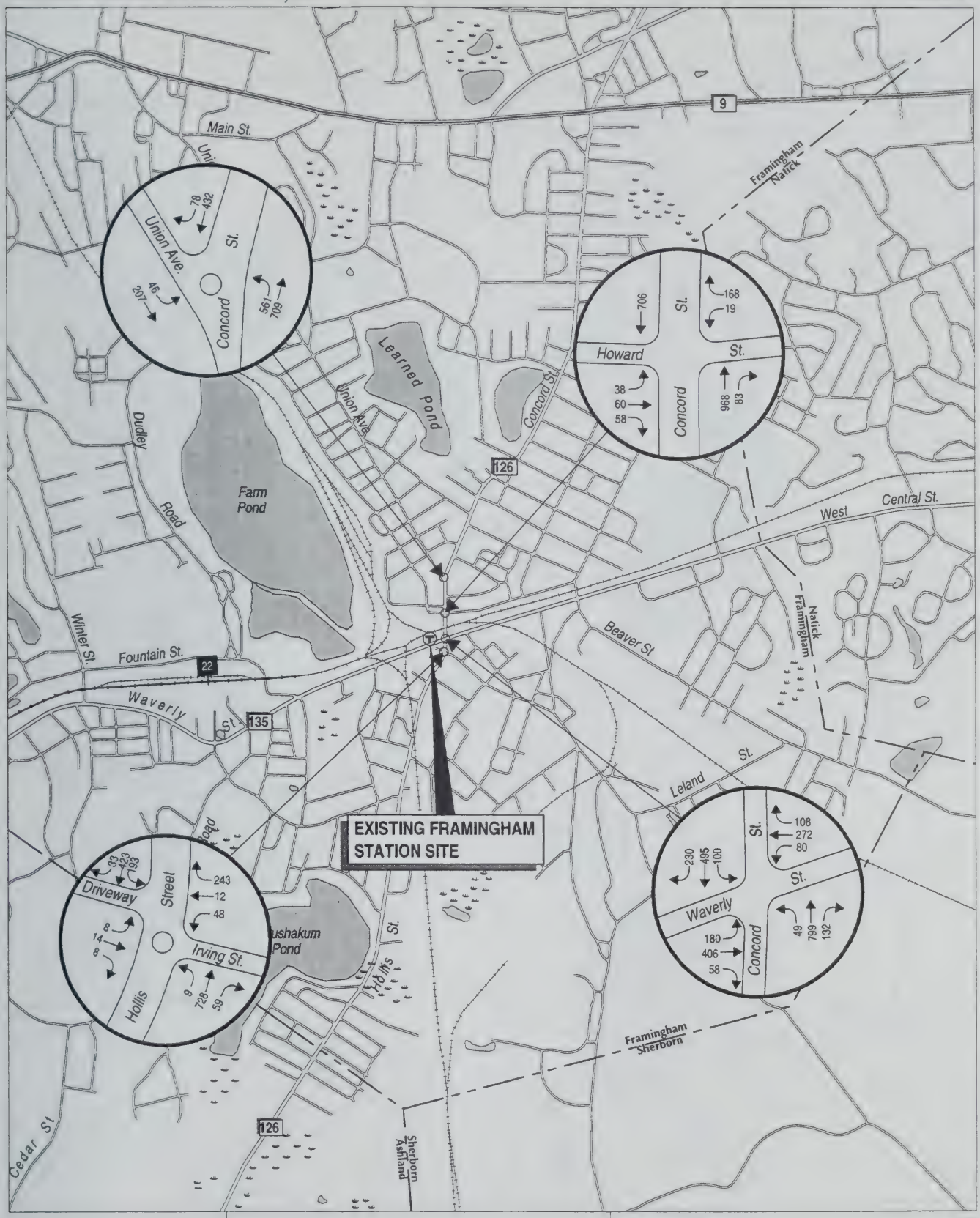
Route 126 runs in the north/south direction and consists of two traveled lanes in each direction. It is a major arterial connecting the downtown area with Route 9. Route 135 runs in the east/west direction and is the only direct connection from Ashland to Natick.

Data Collection

Existing traffic data for the two considered intersections was obtained from completed traffic impact reports associated with sites adjacent to the station and other design reports completed for the town of Framingham. The studies concluded that traffic background growth has been at steady 2 percent increase per year for the past three years.

The base condition is 1994 traffic volumes existing prior to initiation of Interim Service to Worcester in September 1994. The background traffic volumes for that year were derived by factoring down the 1996 turning movement volumes at 2 percent a year, then the traffic volumes generated by the ridership was added to the background traffic to derive the total traffic. Traffic volumes for the year 1994 A.M. and P.M. peak hours are shown on Figures I-3 and I-4, and for the year 1996 A.M. and P.M. peak hours on Figures I-5 and I-6.

The future year 2001 traffic volumes were derived by increasing background traffic by 2 percent per year, and adding the volume of traffic generated by the station ridership in that year. Traffic volumes for the year 2001 A.M. and P.M. peak hours are shown on Figures I-7 and I-8.



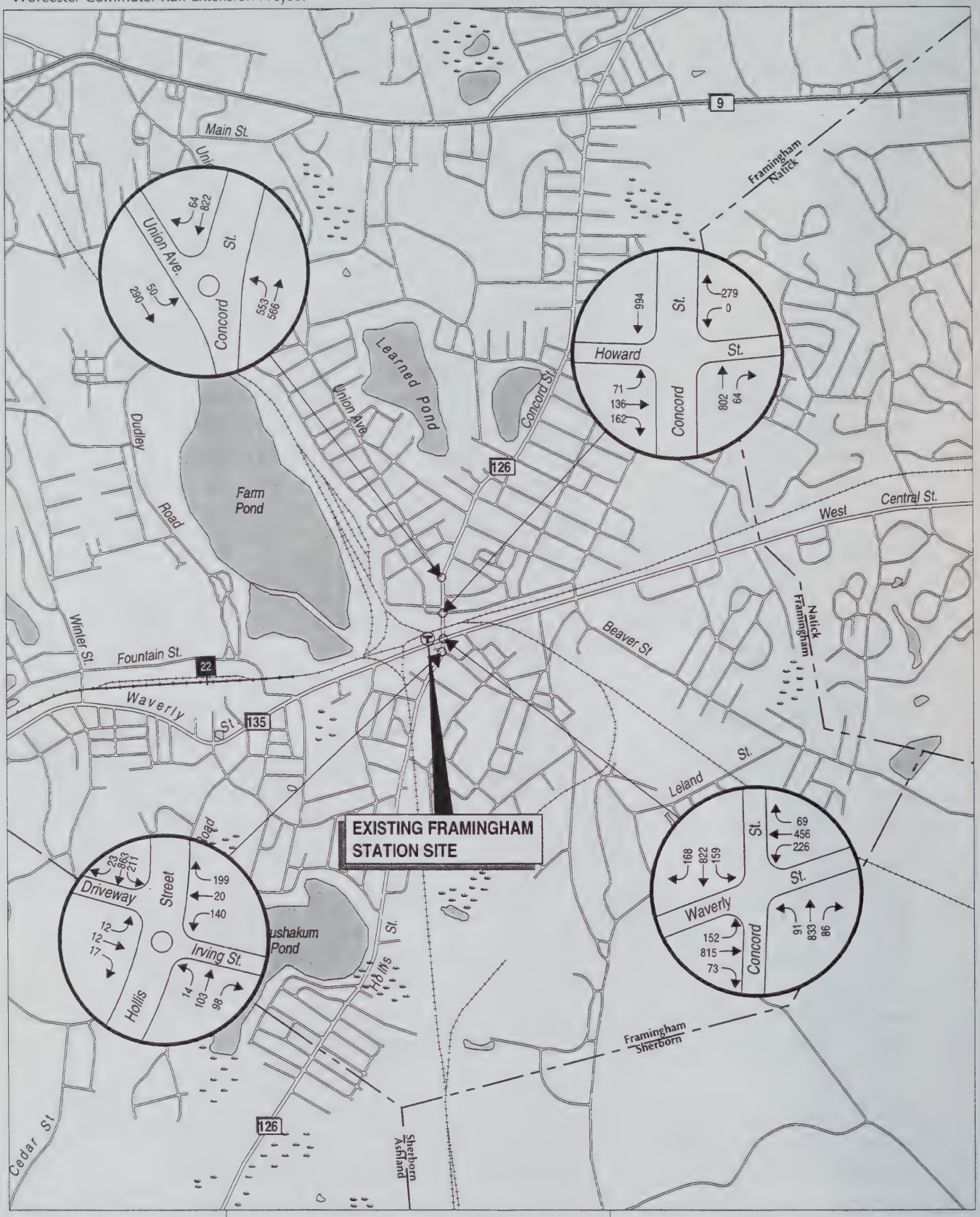
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

0 2000

AM Peak Hour
1994 Existing Conditions
FRAMINGHAM STATION

FIGURE I-3



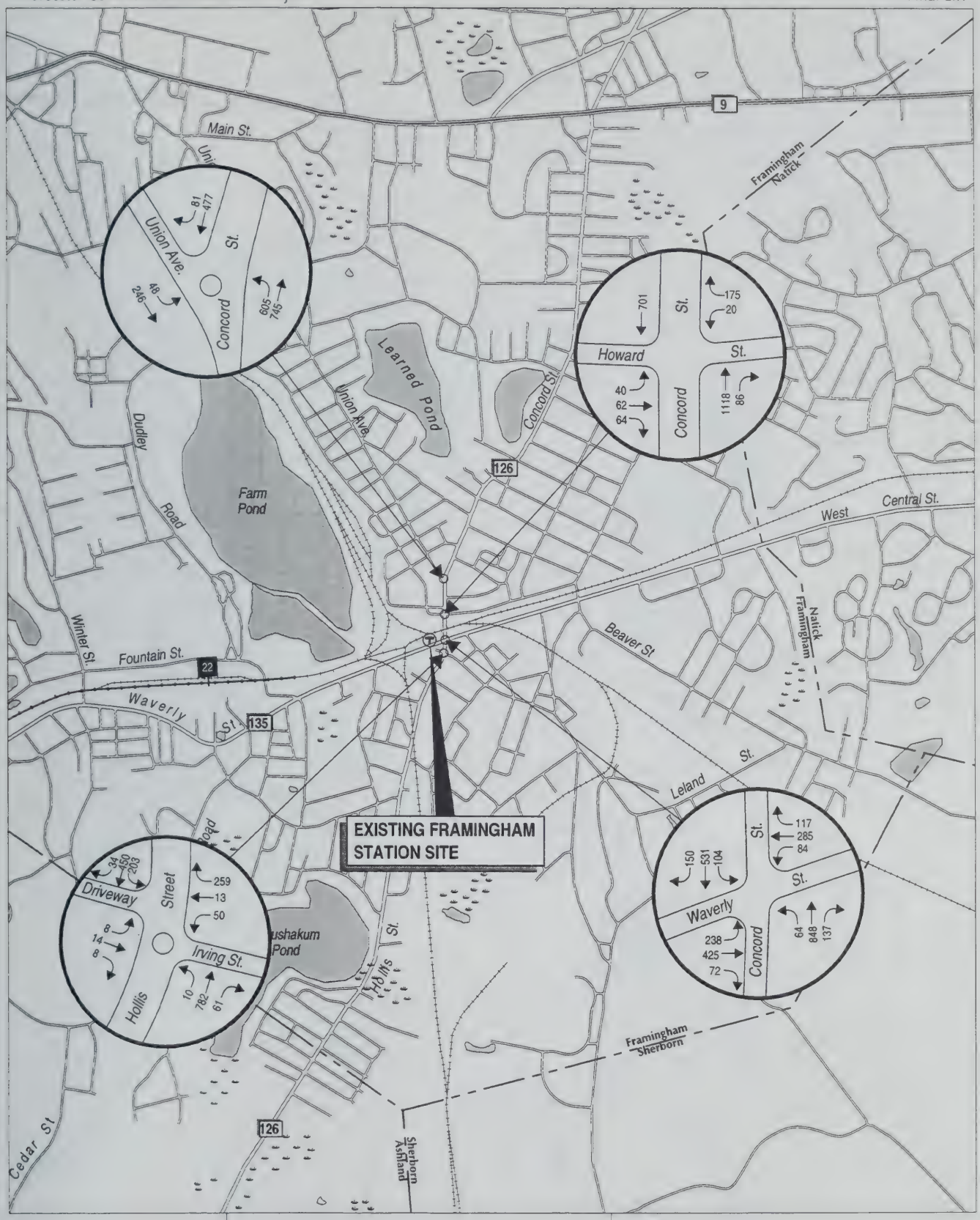
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

0 2000

PM Peak Hour
1994 Existing Conditions
FRAMINGHAM STATION

FIGURE I-4



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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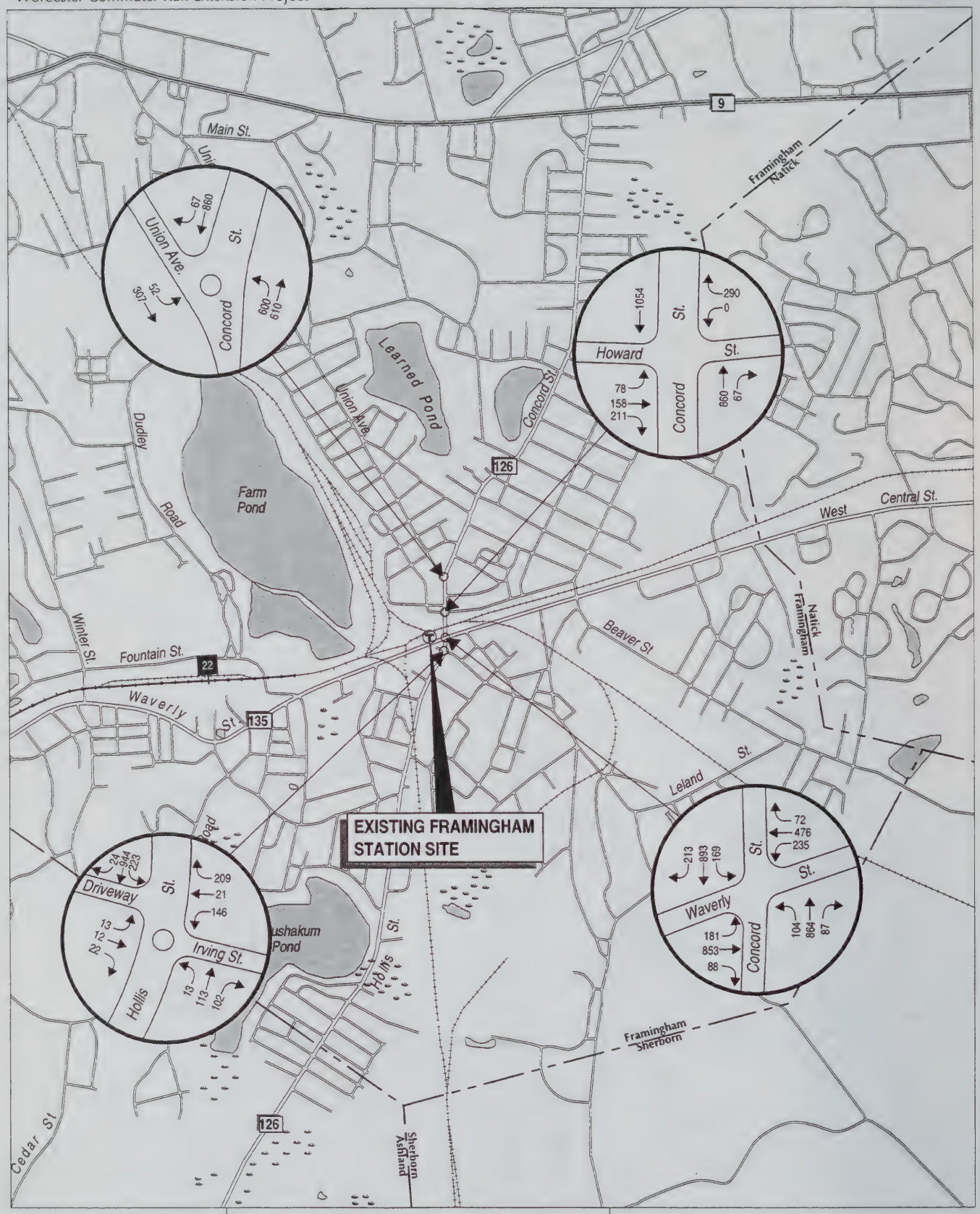
AM Peak Hour
1996 Build-Millbury & Grafton Only
FRAMINGHAM STATION

FIGURE I-5



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

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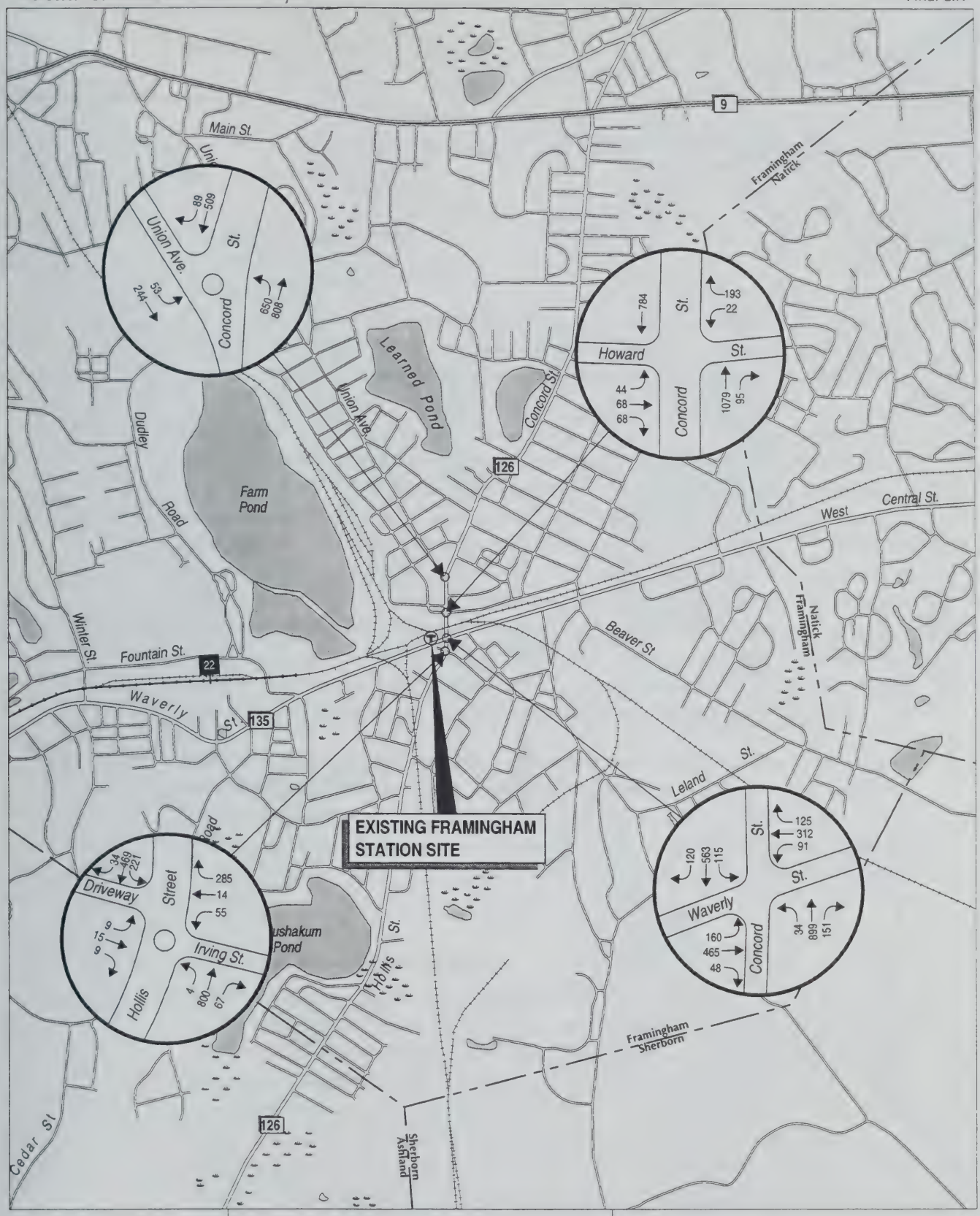
PM Peak Hour
1996 Build-Millbury & Grafton Only
FRAMINGHAM STATION

FIGURE I-6



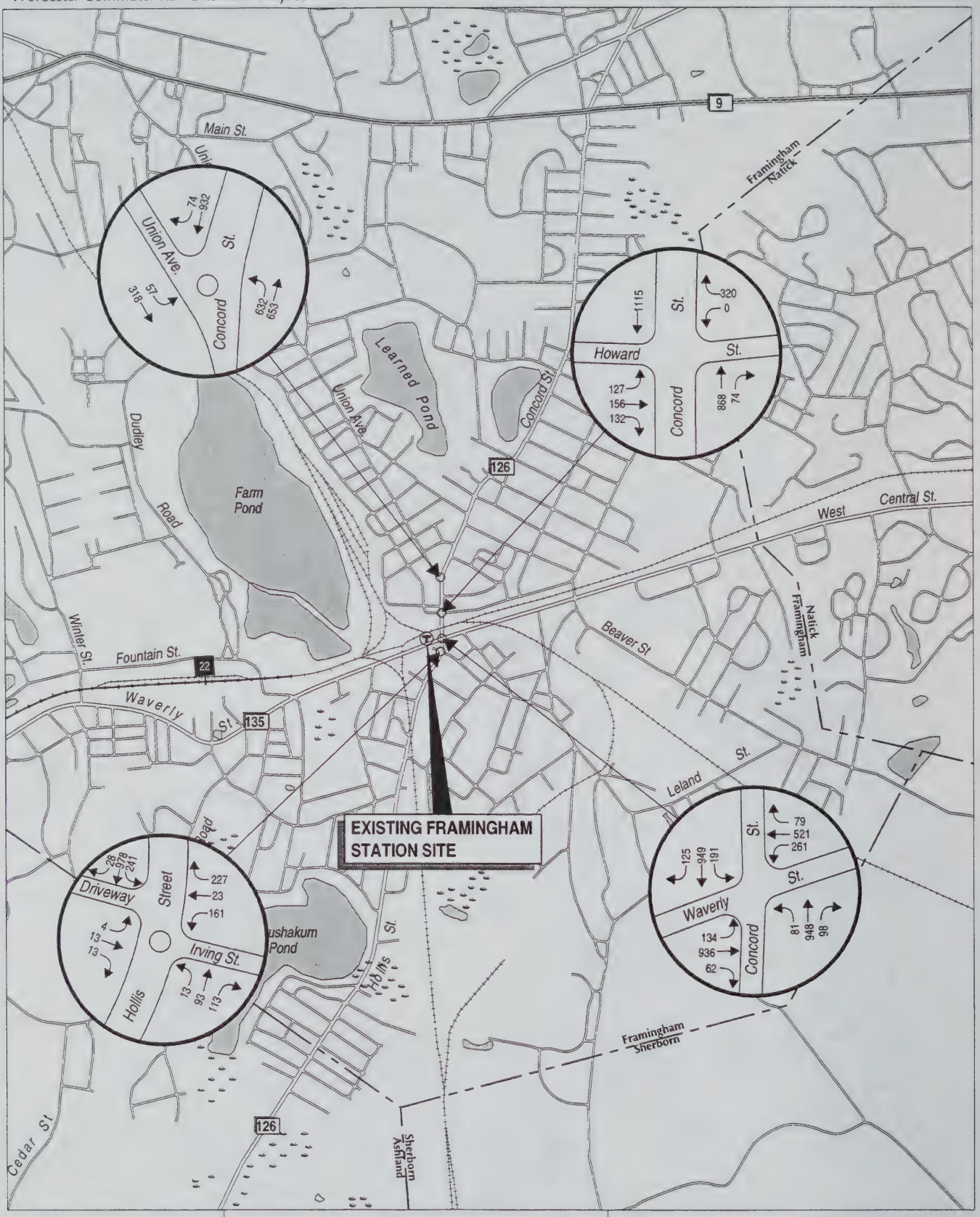
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

0 2000

AM Peak Hour
2001 Build-All Stations
FRAMINGHAM STATION

FIGURE I-7



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

0 2000

PM Peak Hour
2001 Build-All Stations
FRAMINGHAM STATION

FIGURE I-8

Intersection geometric configuration were available from the town, aerial photographs and field investigation.

Year 1994 Existing Conditions

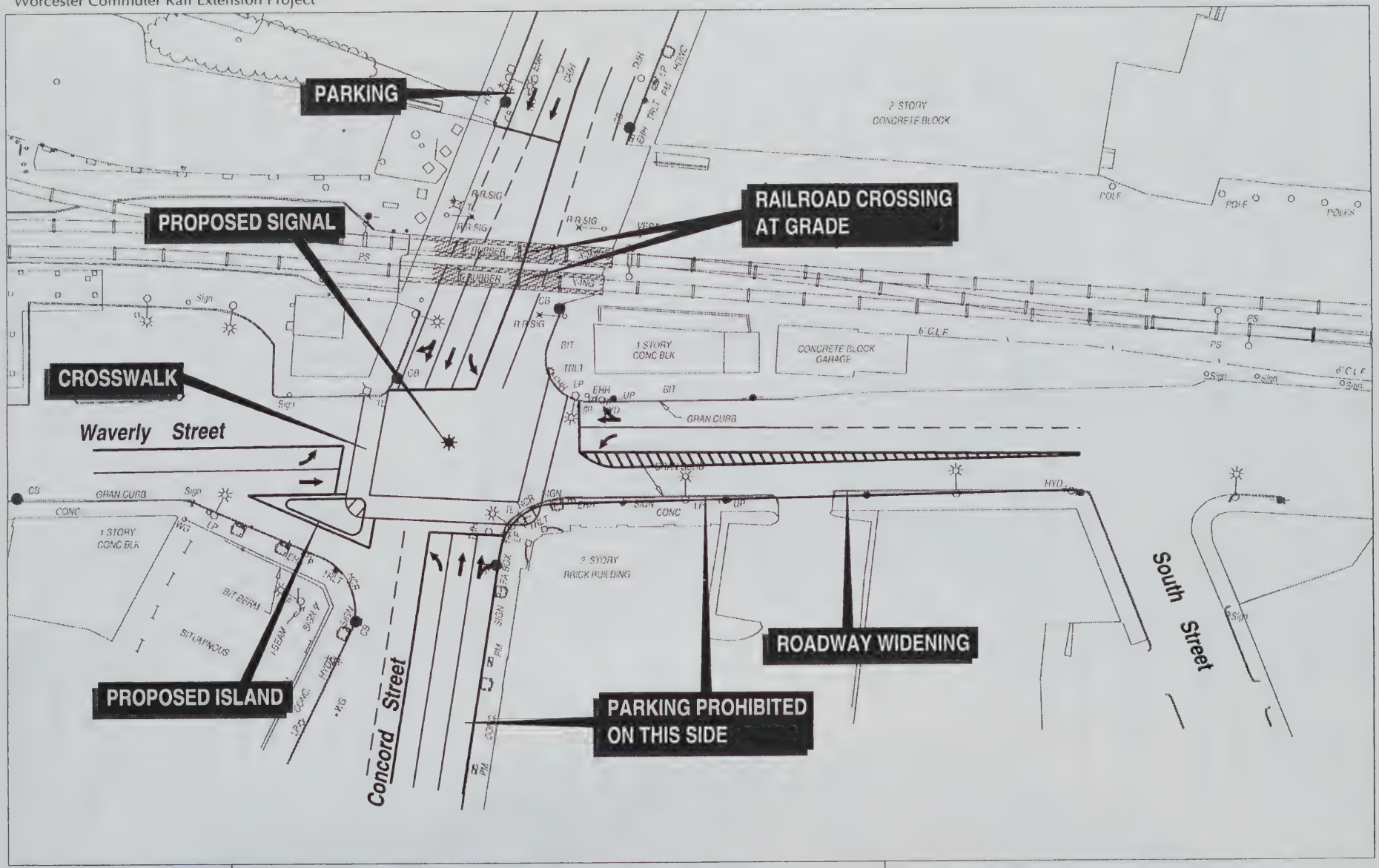
Signalized Intersections

The existing signalized intersections were analyzed using the methodology set forth in the 1985 Highway Capacity Manual (HCM) Transportation Research Board, Special Report 209. The micro-computer software package "CINCH," developed by the Central Transportation Planning Staff (CTPS) was used for the analysis. CINCH is the approved software by MEPA for conducting capacity analyses. A 1994 HCM has been published, and effective immediately, the methodologies for capacity analysis calculations must be used for EIR traffic impact studies submitted for review under MEPA. This requirement is made necessary by federal regulations (23 CFR 625.5) which are being updated to reference the 1994 HCM. The Executive Office of Environmental Affairs (EOEA) and the Executive Office of Transportation and Construction (EOTC) are in the process of updating the current "Guidelines for EIR/EIS Traffic Impact Assessment." In particular, the updated guidelines may identify a specific 1994 HCM based software package for required use. For this report we have utilized the presently approved CINCH software and changed the base saturation flow from 1,800 to 1,900 passenger cars per hour per green time per lane (pcphgpr) as required by the 1994 HCM.

The existing traffic signals operate on a pretimed sequence; an approach will be given the preset green time even if no traffic is entering the intersection on that approach. During railroad preemption, all traffic movements are required to stop under the existing set-up. The periodic gate closings effectively reduce intersection capacity under the existing configurations. Two signalized intersections were analyzed and include the following:

Concord Street/Waverly Street Intersection

This four-legged intersection is located east of the station and within 50 feet south of the tracks. Traffic control at this intersection is an outdated pretimed system. The existing constraints at the intersection prohibit major physical changes to the roadway geometry. The existing pavement width is sufficient for a revised channelization, and prohibition of on-street parking would permit the addition of more traffic lanes. Two design alternative improvements were analyzed for this intersection, as shown on Figures I-9 and I-10. This intersection operates at LOS F in the 1994 A.M. peak hours and LOS F in the 1994 P.M. peak hours. Table I-1 summarizes existing 1994 LOS and average delays in seconds per vehicle during A.M. and P.M. peak hours.



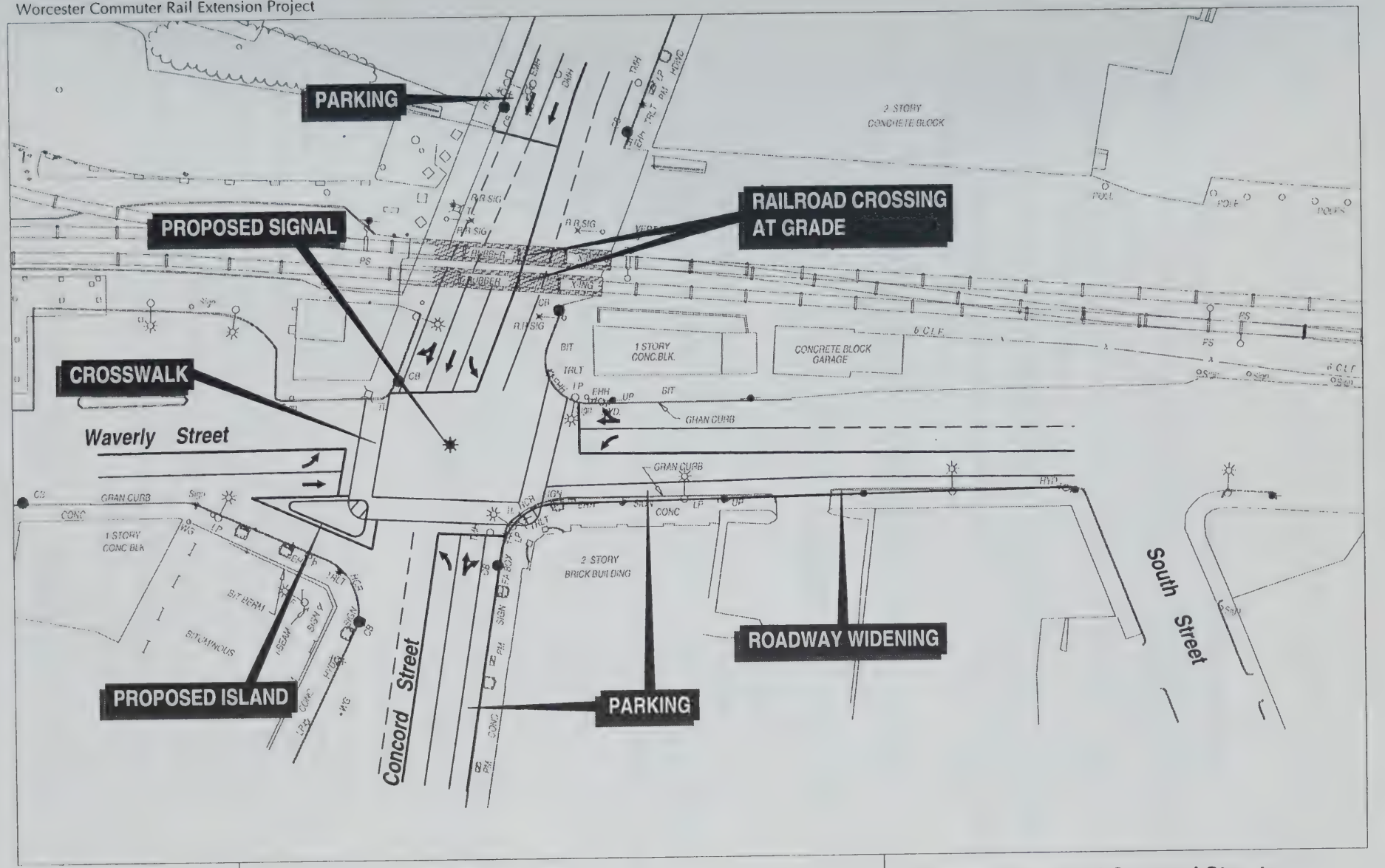
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 60'

0 60

Waverly Street and Concord Street Intersection - Framingham Proposed Improvements - Alternative 1

FIGURE I-9



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 60'

0 60

Waverly Street and Concord Street Intersection - Framingham Proposed Improvements - Alternative 2

FIGURE I-10

Concord Street/Howard Street Intersection

This four-legged intersection is located north of the tracks. Traffic control at this location is a non-conforming pretimed traffic signal control.

Howard Street approach west of Concord Street is one way into the intersection. The existing lane configuration is sufficient for an acceptable level of service operation. Frequent gate closings generate long traffic queues which block the intersection and disable its operation during preemption. This intersection operates at level of service B for both the A.M. and P.M. peak conditions. Table I-1 summarizes existing 1994 level of service and average delays in seconds per vehicle during A.M. and P.M. peak hours.

Table I-1 Signalized Intersection Level of Service - Existing Conditions

Location	1994	
	A.M.	P.M.
Route 126 (Concord Street) at Route 135 (Waverly Street)		
Eastbound	F (140)	F (277)
Westbound	F (70)	F (INF)
Northbound	F (164)	F (365)
Southbound	E (40)	F (387)
Overall	F (106)	F (302)
Route 126 (Concord Street) at Howard Street		
Eastbound	C (18)	C (17)
Westbound	C (18)	B (12)
Northbound	B (6)	B (11)
Southbound	A (4)	B (13)
Overall	B (7)	B (13)

LOS (Average Vehicle Stopped Delay in Seconds)
INF = Infinity, which is an indication of breakdown of the intersection operation.

Year 1996 Conditions

To determine the traffic capacity conditions at the two intersections, analyses were completed for the 1996 A.M. and P.M. peak hours. Two analyses were completed, one with existing geometric condition, and the other with proposed improvements. For the proposed improvements at Waverly Street intersection, two alternatives are provided. The first requires removing curbside parking to provide additional traffic lanes and increase capacity, and the second alternative not removing parking. As mitigation for the impact of additional gate closings due to the Worcester Extension, the MBTA proposes to replace the existing traffic signal control system with a new control system conforming to MUTCD, State, and Federal standards.

Year 1996 with Basic Service

The Concord Street/Waverly Street intersection with existing geometry operates at LOS F during the A.M. and P.M. peak hours. Alternative 1 improvements, including roadway widening, improves the LOS to D in the A.M. peak hour while the P.M. peak hour remain at LOS F.

Alternative 2 improvements result in LOS F for the A.M. and P.M. peak hours.

For both Alternatives the delays will be decreased. See Table I-2 for capacity analysis LOS and delays.

The Concord Street/Howard Street intersection, with existing geometry, operates at LOS B and C during the A.M. and P.M. peak hours, respectively. With a new traffic control signal system, fully actuated, and traffic responsive, a LOS B is achieve during the A.M. and P.M. peak hours. Table I-3 summarizes the LOS and delays for the existing and proposed conditions.

Year 2001 with Basic Service

Concord Street/Waverly Street intersection with existing geometry operates at LOS F during the A.M. and P.M. peak hours. Proposed improvements under Alternative 1 improves the LOS to D in the A.M. peak hour while the P.M. peak hour remain at LOS F.

Improvements under Alternative 2 will operate at LOS F in both A.M. and P.M. peak hours. Table I-2 summarizes the LOS and delays for the existing and proposed conditions.

The Concord Street/Howard Street intersection operates at LOS B during the A.M. and P.M. peak hours for the existing and proposed conditions. Proposed conditions will reduce traffic delays. Table I-3 summarizes the LOS and delays for the existing and proposed conditions.

Table I-2 Signalized Intersection Level of Service - Route 126 at Route 135

Location	Existing Conditions		Proposed Conditions Alternative 1		Proposed Conditions Alternative 2	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
1996						
Eastbound	F (576)	F (372)	D (38)	F (101)	F (475)	F (415)
Westbound	F (108)	F (INF)	D (35)	E (59)	F (178)	F (204)
Northbound	F (223)	F (434)	D (31)	F (97)	F (202)	F (438)
Southbound	D (26)	F (615)	C (22)	F (233)	D (25)	F (79)
Overall	F (232)	F (INF)	D (30)	F (134)	F (207)	F (275)
2001						
Eastbound	F (288)	F (416)	E (43)	F (176)	F (265)	F (634)
Westbound	F (169)	F (INF)	E (50)	F (93)	F (258)	F (317)
Northbound	F (320)	F (557)	E (41)	F (162)	F (292)	F (681)
Southbound	D(28)	F (497)	C (22)	F (208)	D (38)	F (132)
Overall	F (205)	F (INF)	D (38)	F (165)	F (208)	F (433)

Table I-3 Signalized Intersection Level of Service - Route 126 at Howard Street

Location	Existing Conditions		Proposed Conditions	
	A.M.	P.M.	A.M.	P.M.
1996				
Eastbound	C (19)	D (28)	C (16)	C (24)
Westbound	C (18)	B (12)	C (16)	B (10)
Northbound	B (6)	B (12)	B (5)	B (10)
Southbound	A (4)	B (14)	A (4)	B (12)
Overall	B (8)	C (15)	B (6)	B (13)
2001				
Eastbound	C (20)	C (22)	C (17)	C (18)
Westbound	C (20)	B (13)	C (16)	B (11)
Northbound	B (6)	B (12)	B (6)	B (10)
Southbound	A (5)	C (16)	A (4)	B (13)
Overall	B (8)	B (15)	B (7)	B (13)

LOS (Average Vehicle Stopped Delay in Seconds)
INF = Infinity, which is an indication of breakdown of the intersection operation.

Future Year 2001 traffic volumes were derived by applying 2% per year for background traffic (traffic volumes not associated with the station), and ridership data available from CTPS "Ridership Estimates" updated in January 1996, as shown on Table I-4.

Table I-4 Framingham Ridership by Town of Origin

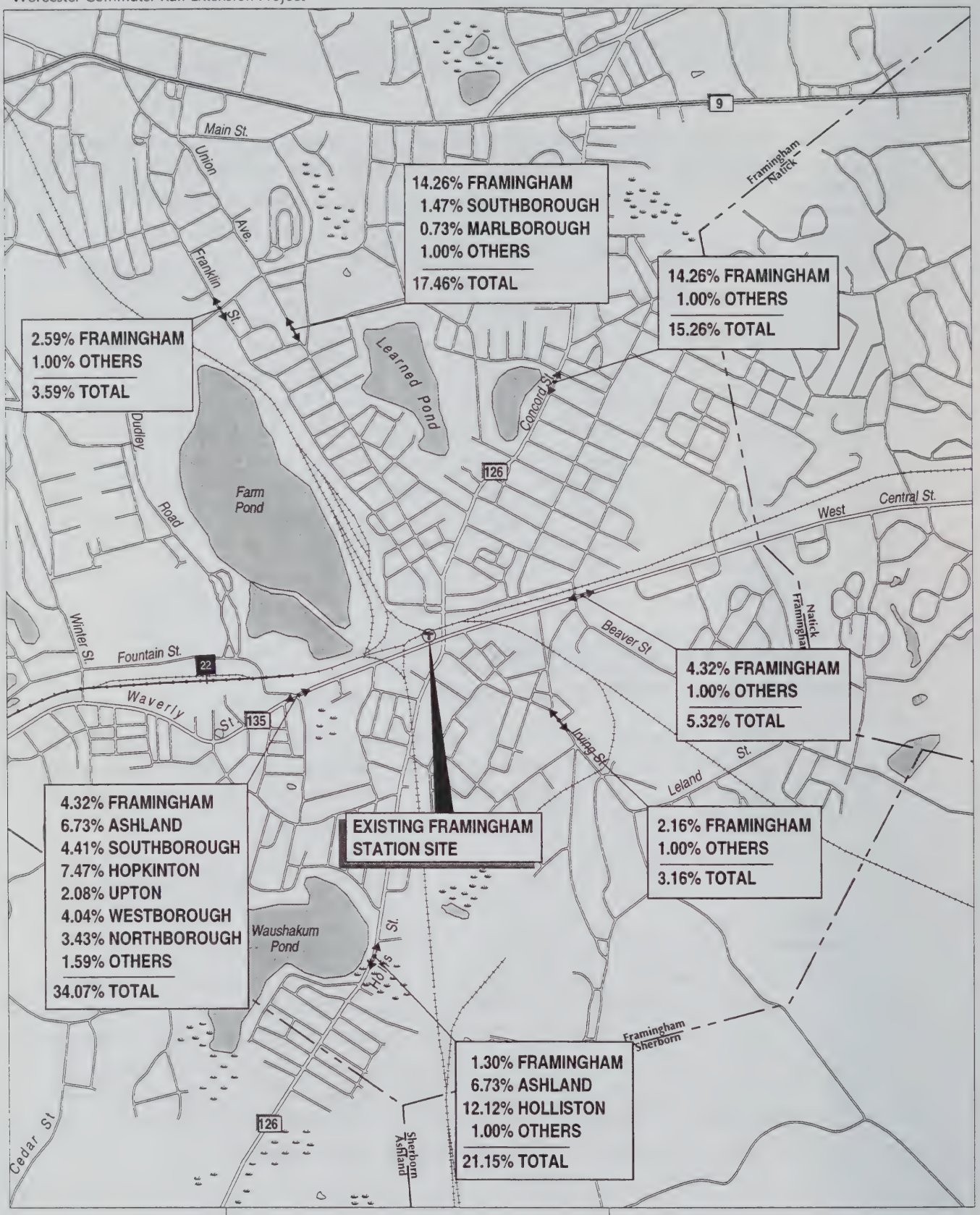
Town of Origin	1994 w/o Interim Service*	1996 with Basic Service**	2001 with Basic Service
Framingham	-	597	618
Holliston	-	168	32
Ashland	-	186	22
Southborough	-	81	
Hopkinton	-	103	
Marlborough	-	16	
Upton	-	22	
Westborough	-	63	
Northborough	-	65	
Other	-	66	70
Total	977	1,367	742

* Distribution prior to Interim Service not available. Traffic analysis assumed distribution proportional to 1996 ridership.
** Applicable to 1996 with Interim Service as well.

Traffic volumes associated with the station were calculated and the distribution was based on the ridership data, Figures I-11 and I-12 show the distribution of commuter rail station traffic for the 1996 build "Millbury & Grafton only stations" and 2001 build "All Stations" respectively.

Parking

Existing parking facilities accessible to the general public and located within walking distance of Framingham station are shown on Figure I-13. Ridership demand for parking exceeds the current supply of parking spaces on MBTA or town lots. Additional parking spaces are being proposed to help alleviate the shortage of spaces, but demand will continue to exceed supply for the near term. By the year 2001, all stations between Worcester and Framingham will be built, and parking demand will decrease as the number of riders decreases, then parking supply will be adequate.



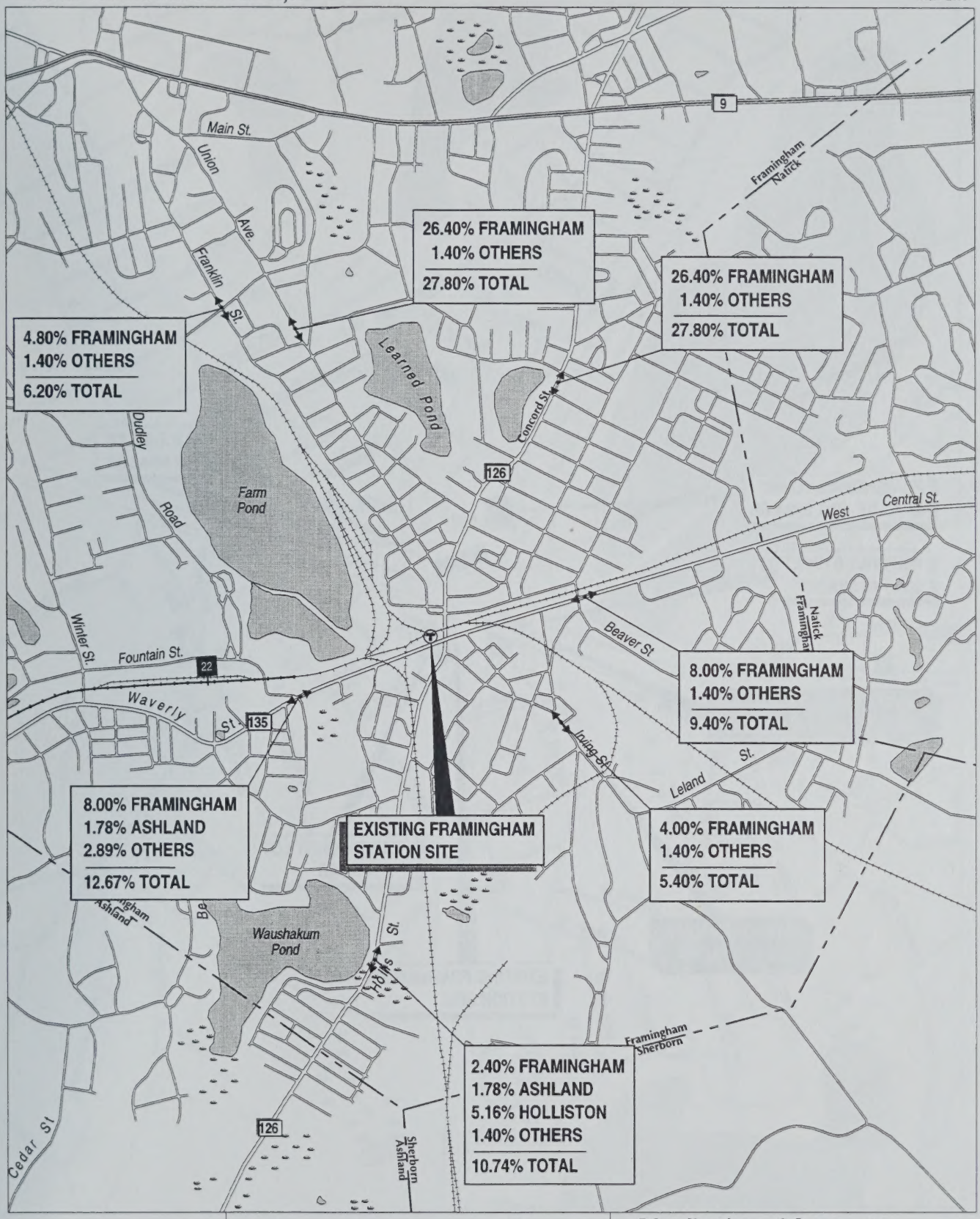
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

0 2000

Distribution of Commuter Rail Station Traffic
1996 Build-Millbury & Grafton Only
FRAMINGHAM STATION

FIGURE I-11



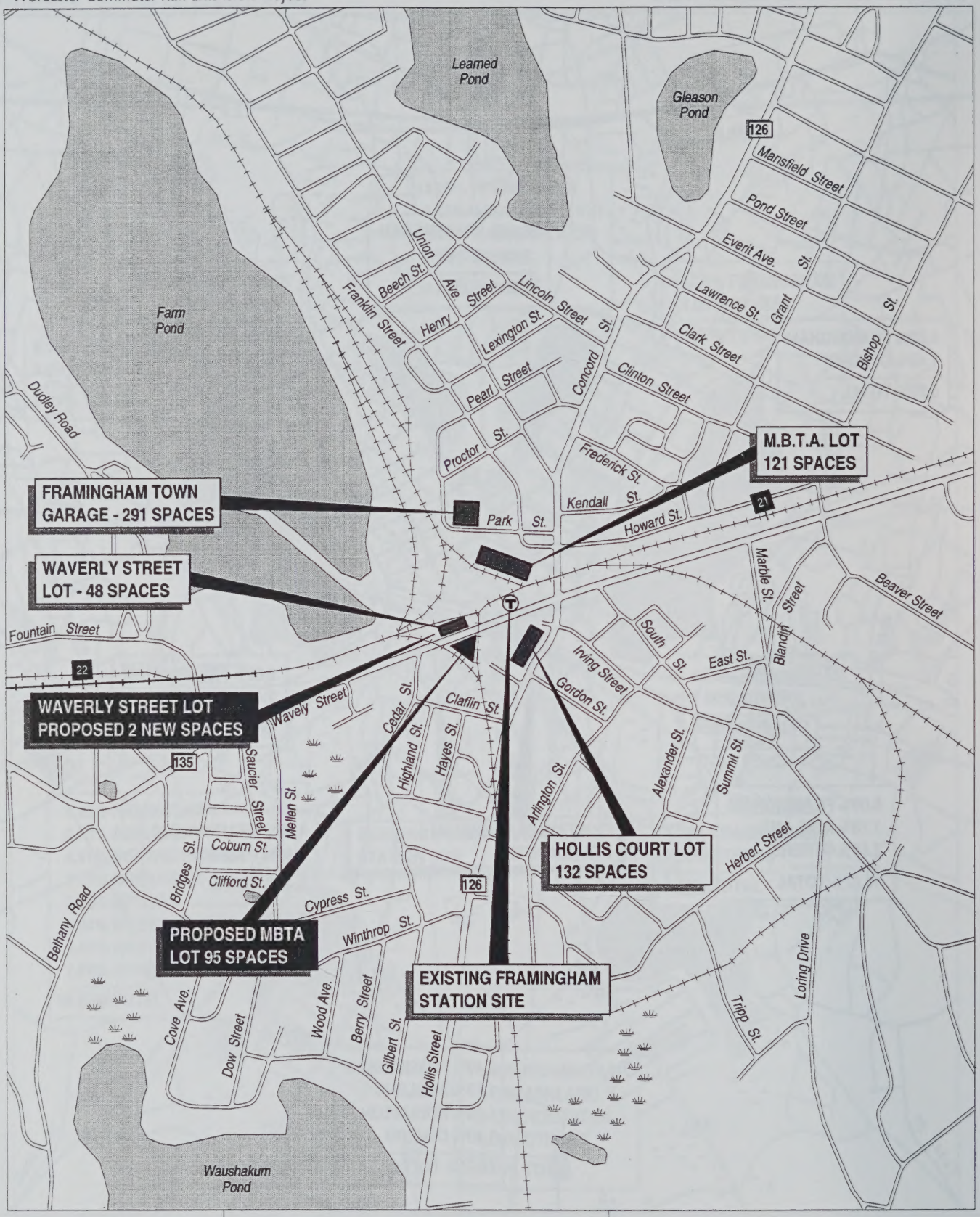
Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 2000'

0 2000

Distribution of Commuter Rail Station Traffic
2001 Build-All Stations
FRAMINGHAM STATION

FIGURE I-12



Massachusetts Bay Transportation Authority

Approx. Scale: 1" = 1000'

0 1000

COMMUTER PARKING AT FRAMINGHAM STATION

FIGURE I-13